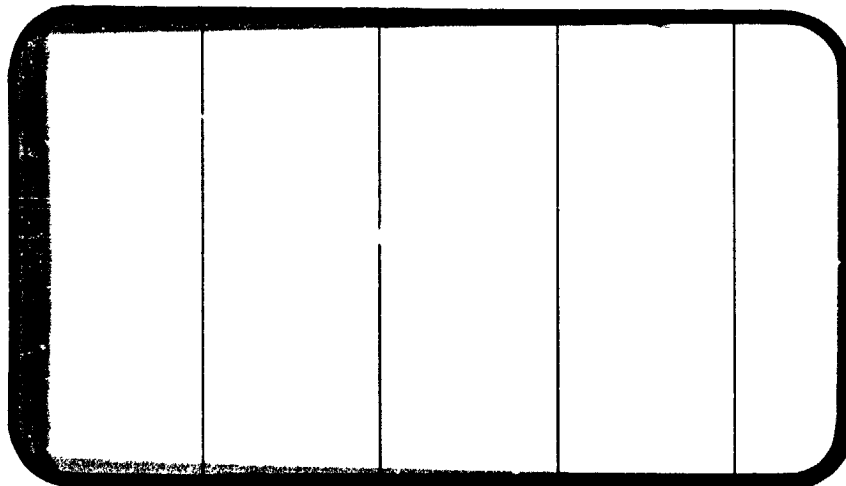


NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA CR-

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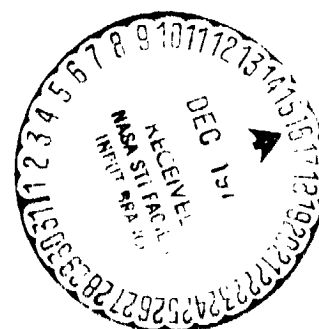
(NASA-CR-134425) A HYPERSONIC FORCE AND
MOMENT TEST OF A 0.006 SCALE MODEL (466)
OF THE 330.2 INCH DIAMETER EXTERNAL TANK
IN THE AMES RESEARCH CENTER (Chrysler
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SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT



JOHNSON SPACE CENTER

HOUSTON, TEXAS

DATA Management services

SPACE DIVISION

CH CORPORATION

November, 1974

S-DR-2181
NASA CR-134,425

A HYPERSONIC FORCE AND MOMENT TEST OF A
0.006 SCALE MODEL (466) OF THE 330.2 INCH DIAMETER
EXTERNAL TANK IN THE AMES RESEARCH CENTER
3.5 FOOT HYPERSONIC WIND TUNNEL (TA9F)

By

P. E. Ramsey, MSFC
T. C. Davis, NSI

Prepared under NASA Contract Number NAS9-13247

by

Data Management Services
Chrysler Corporation Space Division
New Orleans, La. 70169

for

Engineering Analysis Division

Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number: ARC 3.5 HWT 196
NASA Series Number: TA9F
Test Dates: 30 May through 12 June 74
Occupancy Hours: 120
Model Number: 466

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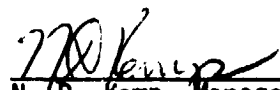
Phone: (205) 837-0580 X282

DATA MANAGEMENT SERVICES:

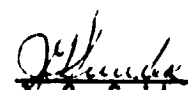
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A HYPERSONIC FORCE AND MOMENT TEST OF A 0.006 SCALE MODEL (466) OF
THE 330.2 INCH DIAMETER EXTERNAL TANK IN THE AMES RESEARCH
CENTER 3.5 FOOT HYPERSONIC WIND TUNNEL (TA9F)

By

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ABSTRACT

A wind tunnel force and moment test of the Space Shuttle External Tank (NASA series test number TA9F) was conducted at the Ames Research Center 3.5 Foot Hypersonic Wind Tunnel during June of 1974. The wind tunnel model was a 0.006 scale model of the 330.2 inch diameter External Tank with nose cap and lightning rod.

Data were obtained over an angle-of-attack range from 0 to 180 degrees at Mach numbers of 5.3 and 10.4. Body roll angles varied from 0 to 315 degrees for the Mach number 10.4 tests. A constant roll angle of 180 degrees was used for all Mach number 5.3 tests. The effects of protuberances and Reynolds number on the force and moment coefficients were investigated.

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PLOT SCHE LES:

- A) CNM, CA, CL , CYM, CY , CBL, XCP/L VS. ALPHA
- B) CAF, CAB VS. ALPHA
- C) C , CA, C , CYM, CYNM, CBL, XCP/L VS. PHI
- D) CAF, VS. PHI
- E) DC , , DC , DCYM, DCYNM, DCBL VS. ALPHA
- F) F, DC VS. ALPHA

INTRODUCTION

The Space Shuttle External Tank (ET) will be separated from the Orbiter before orbit is achieved. The ET will then reenter the atmosphere at hypersonic speeds. Since the ET is not designed structurally to withstand reentry, the combined force and heat loads are expected to break it up before impact in the Indian Ocean. The size of the "footprint" formed by falling pieces of the ET will depend on the altitude that breakup occurs. Therefore, to predict the altitude of breakup and thus the footprint, reliable estimates of aerodynamic heating rates and forces and moments must be obtained over the entire reentry trajectory. The purpose of this report is to present the results of a hypersonic force and moment test of the ET in the NASA Research Center 3.5' hypersonic tunnel.

The model tested was a 0.0 scale representation of the 330.2" diameter External Tank with nose cap. Photographs of the model, installed in the tunnel, are presented in Figures 3a through 3c. The configuration reference drawing is Rockwell International drawing VL78-00 62B. A reproduction of the basic ET from this drawing is shown in Figure 2a. The model included scaled protuberances.

The test was conducted primarily at a Mach number of 10.4 but some data were taken at Mach 5.3. For Mach 10.4, data were recorded at thirty-six (36) angles-of-attack between 0° and 180° and at eight (8) roll angles between 0° and 360° . At Mach 5.3, data were obtained only at 180° roll angle and at angles-of-attack between 0° and 180° . The test covered a range of Reynolds numbers that correspond to an altitude range from

INTRODUCTION (Concluded)

35,000 and 80,000 feet as defined in the trajectory of Reference 1. Since portions of the test occurred near the transition flow regime, data at Mach 10.4 and roll angle of 0° were taken at the maximum and minimum Reynolds number capability of the facility to check for variation with Reynolds number.

The test required approximately 120 hours of test time. It began on 30, 1974. The test was assigned a test number of 196 and a SA series number of TA9F.

N ENCLATURE

GENE L

<u>SYM L</u>	<u>PLOT SYM L</u>	DEFINITI	<u>UNITS</u>
A_b		base area; cross-sectional area of the cylindrical ET	in. ²
A_c		cavity area, area of the opening required for the balance and sting	in. ²
		Balance nt Center	
b_{ref}	B F	reference span; diameter of the cylindrical section of the el	in.
c.g.		center of gravity	
ET		External Tank	
F_A		axial force (AF), positive in the negative direction of x	lb
F_N		no 1 force (NF), positive in the negative direction of z	lb
F_y		side force (SF), positive in the positive direction of y	lb
l_{ref}	LREF	reference length; dia ter of the cylindrical section of the el	in.
M	CH	ch number	
MRP	P	nt Reference Point (Located in the x, y, z axes by , YMRP, and RP)	
M_x		rolling nt (); a t about the x-axis (a positive rolling nt tends to rotate the positive y-axis t rd the positive z-axis)	in.-lb

N NCLATURE (Continued)

SY OL	PLOT SY OL	FINITI	UNITS
M_y		pitching nt (); a nt about the y-axis (a positive pitching nt tends to rotate the positive z-axis toward the positive x-axis)	in.-lb
M_z		yawing nt (); a nt about the z-axis (a positive yawing nt tends to rotate the positive x-axis toward the positive y-axis)	in.-lb
q_∞	Q(Psi)	f stream dynamic pressure	psi
/L	/L	unit ynolds n r	per ft
S_{ref}	SREF	reference area; cross-sectional area of the cylindrical ET	in. ²
P		pressure	psi
SRB		Solid Rocket ster	
T		t rature, °F	

MISSILE IS SYSTEM C FFICIE S

C_{A_m}	CA	axial force; $F_A/q_\infty S_{ref}$
C_{A_b}		se axial force; $(P_\infty - P_b) A_b/q_\infty S_{ref}$
$C_{A_{fm}}$	CAF	fore axial force; $C_A - C_{A_b}$
C	CBL	rolling t; $M_x/q_\infty S_{ref} b_{ref}$
C_{m_m}	C	pitching t; $M_y/q_\infty S_{ref} l_{ref}$
C_{n_m}	C	io l force; $F_N/q_\infty S_{ref}$

N ENCLATURE (Continued)

<u>SY</u> <u>OL</u>	<u>PLOT</u> <u>SY</u> <u>L</u>	<u>DEFINITI</u>
C_{n_m}	CYNM	yawing . nt; $M_z/q_\infty S_{ref} b_{ref}$
C_p	CP	pressure coefficient; $(P_1 - P_\infty)/q_\infty$
C_{Y_m}	CYM	side force; $F_Y/q_\infty S_{ref}$
ΔC	DCA	incremental axial force coefficient
ΔC_{A_b}	DC	incr ntal base axial force coefficient
$\Delta C_{A_{f_m}}$	AF	incr ntal fore y axial force coefficient
ΔC_{l_m}	DCBL	incr ntal rolling nt coefficient
ΔC		inc ntal no l force coefficient
ΔC_{m_m}		inc ntal pitching nt coefficient
ΔC_{n_m}	DCY	incr ntal yawing nt coefficient
ΔC_{Y_m}	DCYM	incr tal side force coefficient
X_{cp}/L	XCP/L	center of pressure location, where XCP is the center of pressure location in te of the deci l fraction of ET length (1846.9) aft of the ET nose (sta 328.92), $XCP/L = 0.5832 - 0.17 (C / CNM)$
ϕ	PHI	angle of roll, g. (f a pilot's viewpoint in an airplane, a positive roll angle is a clockwise rotation)
TC		test condition n r, see Test Condition Section
ref		subscript, reference conditions
-		subscript, freestre conditions
b		subscript, base
c		subscript, cavity

NOMENCLATURE (Concluded)

<u>SY</u> <u>OL</u>	<u>PLOT</u> <u>SYMBOL</u>	DEFINITION
t		subscript, total conditions
m		subscript, missile axis
α		angle of attack in the body axis system, degrees
β	BETA	angle of sideslip in the body axis system, degrees.
α_T	ALPHA	angle of attack in the missile axis system, degrees.

CONFIGURATIONS INVESTIGATED

The model configuration for this test was defined by Rockwell International drawing VL78-000062B. A part of this drawing is reproduced in Figure 2a.

The model is a 0.006 scale representation of the Space Shuttle External Tank. Model length including the nose cap is 11.303 inches and model diameter is 1.98 inches. The model was machined in several parts to allow maximum utilization of all model parts while testing with different sting arrangements. The model could be mounted on the sting by the nose, tail or side. This allowed coverage of angles-of-attack from 0° to 180° with minimum sting interference. The basic model parts are the nose tip, the nose plug, the nose, the center body, the base and the base plug. These parts are shown in Figure 2b. Two center bodies were constructed. The first one, to be tested in the nose or tail mounted positions, could be rotated to cover the 0° to 315° roll angle range without removal of the protuberances. The second, to be tested in the side mount position, could not be rotated. All center body protuberances had to be moved each time a new roll angle was desired. The nose and tail sections were rotated to cover all of the roll angles without removing the protuberances. Drawings of these sections are shown in Figures 2c through 2i.

Only the largest protuberances were modeled (see Fig. 2a). They included the Orbiter-ET attach structure (forward and aft), the forward and aft SRB attach structure, LO_2 feed line, LO_2 recirculation line with electrical conduit and the LH_2 pressure line with electrical conduit.

CONFIGURATIONS INVESTIGATED (Concluded)

Drawings for the protuberances are shown in Figure 2h and in Figures 2j through 2q.

Because of the high temperatures encountered in this test, the balance was insulated with a sleeve especially built for the model. A drawing of the sleeve is shown in Figure 2r. The sleeve was built in 3 layers as shown. The inner layer, which was closest to the balance, was .125 inch thick stainless steel. The outer layer was also stainless steel and was .089 inch thick. The middle layer, or insulating material, was .25 inch thick and made from "G-10 Epoxy Glass" insulation material. The thermal conductivity of this material is 4×10^{-4} cal/sec/cm²/°C/cm. The insulation was machined for a press fit between the inner and outer layers. Eight (8) epoxy glass dowel pins were used to permanently bind all three layers together. A hole through the three layers in four places was used to attach the sleeve to the 3/4 inch diameter Task balance. The sleeve was then placed into the center body and pinned to the body in 2 places. The sleeve contained 8 holes, each equally spaced, to accept the 2 pins. These holes allowed the center body (for the 10° sting) to be rolled in 45° increments around the sleeve. There were no heat paths directly through the model to the balance. No heating problems were encountered during the test.

The model support hardware consisted of a 10° sting, a 90° sting and a sting adapter to connect the sting to the tunnel strut.

An assembly drawing of the model mounted in all three positions is shown in Figure 2s.

TEST FACILITY DESCRIPTION

The Ames 3.5 foot Hypersonic Wind Tunnel is a closed circuit blowdown tunnel capable of operating at nominal Mach numbers of 5.2, 7.4 and 10.4; at pressures to 1800 psia and temperatures to 3400°R for run times to four minutes. The major components of the facility include a gas storage system where the test gas is stored at 3000 psi, a storage heater filled with aluminum - oxide cored brick capable of heating the test gas to 3400°R, contoured nozzles with exit diameters of 42 inches for generating the desired Mach number, and a 900,000 ft³ vacuum storage system which operates to pressures of 0.3 psia. The test section itself is an open-jet type enclosed within a chamber approximately 12 feet in diameter and 40 feet in length, arranged transversely to the flow direction. The length of the jet is approximately 10 feet.

A model support system is provided that can pitch models through an angle-of-attack range of -20 to +18 degrees, in a vertical plane, about a fixed point 1 to 5 feet from the nozzle exit plane. The model is normally out of the test stream until the tunnel test conditions are established, after which it is inserted. Insertion time is adjustable to as little as 1/2 second and models may be inserted at any strut angle. A closed circuit video system with a recorder is available for visually monitoring the experiments within the test cabin.

A data acquisition system accepts analog signals at rates up to 2500 samples per second, converts them into digital form and records on magnetic tape for later reduction by a digital computer.

The tunnel operates two 8-hour shifts per 24-hour day.

INSTRUMENTATION

The balance used in this test was a .75 inch diameter Task balance. The balance is a six component internal strain gage balance. The reference balance drawing furnished by Ames is 6656. The description number given the balance is MK XXIX 6656 B. The load range of the balance is:

Normal Force	= 200 lb
Pitching Moment	= 200 in-lb
Side Force	= 100 lb
Yawing Moment	= 100 in-lb
Axial Force	= 30 lb
Rolling Moment	= 30 in-lb

Because of the small loads at Mach 10.4 as compared to Mach 5.3, a 1/2 load balance calibration was performed. This calibration was used in the data reduction for runs at Mach 10.4. The normal full scale calibration was used in the data reduction for runs at Mach 5.3.

TEST CONDITIONS

The test program consisted of approximately 120 hours of tunnel time. The angle-of-attack range was 0° to 180° in five degree increments. Two stings were used in an effort to minimize sting interference over the angle-of-attack range. The first one, the 10° sting, could be mounted in the nose or tail of the model and was used for angle-of-attack ranges -5° to 30° and 150° to 185° . The angle-of-attack range 30° to 150° was covered using a 90° sting mounted from the side of the model.

Because the sector of the tunnel is only capable of an angle range of -20° to 18° , the sting was mounted in one of three positions on the strut. These positions are assigned a number and are shown in Figure 2t. Number 1 position was 40° above the strut centerline. Number 2 position was on the strut centerline and number 3 was 40° below the strut centerline. In each case the center of rotation was the same. The following notation was used to denote the range to be covered on a run:

NOTATION	STRUT POSITION	STING	STING POSITION	MODEL α RANGE	SECTOR α RANGE
A'	2	10°	Tail	-5° to 30°	-20° to 15°
G	1	90°	Side	30° to 60°	-20° to 15°
F	2	90°	Side	70° to 105°	-20° to 15°
E	3	90°	Side	110° to 145°	-20° to 15°
C'	2	10°	Nose	150° to 185°	-20° to 15°

All increments are 5°

This schedule is illustrated pictorially in Figure 2t.

TEST CONDITIONS (Concluded)

The angle of roll was varied from 0° to 315° in 45° increments. When 10° sting was used the entire model could be rolled about the sting. This eliminated the necessity of removing all protuberances on every run. When the 90° sting was being used, the protuberances located on the center body were removed and relocated. Both the nose and tail could be rotated and protuberances located there were not removed. Runs were made with and without protuberances (clean body).

Test conditions at Mach 5.3 were chosen to restrict the dynamic pressure to a value that would not overload the balance. Test conditions for the runs at Mach 10.4 were chosen on the following bases: An intermediate stagnation pressure and temperature that allowed fast re-cycle time of the tunnel (determined by discussion with Ames personnel); a low and high stagnation pressure and temperature that allow data to be checked on a similarity parameter basis. The resulting test conditions are shown in the following table:

CONDITION NUMBER	M_{∞}	P_t (psia)	q_{∞} (psi)	T_t (°R)	TEST TIME (sec)	R_N/ft $\times 10^{-6}$
1	5.3	275	7.184	1200	140	3.81
2	10.4	400	.512	2000	100	.39
3	10.4	1200	1.720	2000	160	1.16
4	10.4	1800	2.303	2000	180	1.74

DATA REDUCTION

Parameters measured and recorded during this test were:

- o Wind tunnel conditions (P_∞ , P_t , T_t)
- o Six-component force and moment data
- o Sting attitude
- o Base pressure (on the runs where the angle-of-attack range was either -5° to 30° or 150° to 185°).

Tunnel conditions were used to calculate the Mach number, the dynamic pressure, and the Reynolds number; the six-component force and moment data were used to calculate static stability coefficients; the sting attitude and initial model attitude were used to calculate the model angle-of-attack, and the base pressures were used to calculate base pressure coefficients.

The following equations were used to reduce force and moment data to non-dimensional coefficients in the missile axis system.

$$\begin{aligned} C_{N_m} &= \text{normal force coefficient} \\ &= F_N / q_\infty S_{ref} \end{aligned}$$

$$\begin{aligned} C_{m_m} &= \text{pitching moment coefficient} \\ &= M_y / q_\infty S_{ref} \ell_{ref} \end{aligned}$$

$$\begin{aligned} C_{A_m} &= \text{axial force coefficient} \\ &= F_A / q_\infty S_{ref} \end{aligned}$$

$$\begin{aligned} C_{Y_m} &= \text{side force coefficient} \\ &= F_y / q_\infty S_{ref} \end{aligned}$$

$$\begin{aligned} C_{n_m} &= \text{yawing moment coefficient} \\ &= M_z / q_\infty S_{ref} b_{ref} \end{aligned}$$

DATA REDUCTION (Concluded)

$$\begin{aligned} C_{\ell_m} &= \text{rolling moment coefficient} \\ &= M_x/q_\infty S_{\text{ref}} b_{\text{ref}} \end{aligned}$$

$$\begin{aligned} C_{A_{b_m}} &= \text{base axial force coefficient} \\ &= (P_\infty - P_b) A_b/q_\infty S_{\text{ref}} \end{aligned}$$

The positive directions of the forces and moments are shown in Figure 1.

The following reference data were used to reduce the force and moment data to aerodynamic coefficients:

$$S_{\text{ref}} = 3.08 \text{ in.}^2$$

$$\ell_{\text{ref}} = 1.98 \text{ in.}$$

$$b_{\text{ref}} = 1.98 \text{ in.}$$

$$A_b = 3.08 \text{ in.}^2$$

The moment reference point for this external tank configuration was at a tank X station of 1406 (see Fig. 2a). This placed the MRP 1.08 inches aft of the .

The center of pressure location was calculated as follows:

$$X_{CP}/L = 0.5832 - 0.17 \quad (CL/C)$$

where $0.5832 = (X_{\text{MRP}} - X_{\text{NOSE}})/L_{\text{TANK}}$

$$0.1788 = L_{\text{REF}}/L_{\text{TANK}}$$

$$X_{\text{MRP}} = \text{ET MRP station}$$

$$X_{\text{NOSE}} = \text{ET nose station}$$

$$L_{\text{TANK}} = \text{ET length}$$

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5. Davis, Tommy, "A Pre-Test Report for a Hypersonic Force and Moment Test of the .006 Scale 330.2 Inch Diameter External Tank in the Ames Research Center 3.5 Ft. Hypersonic Wind Tunnel", Northrop Services, Inc., M-9230-74-283, May 1974.

TABLE I.
TEST CONDITIONS
TEST 196

[illegible]

CE UTILIZED: MK XXIX 6656 B

C ACTIVITY:

ACCURACY :

**COEFFICIENT
TOLE CE:**

NF	200 lb
SF	100 lb
AF	30 lb
PM	200 in.-lb
	100 in.-lb
	30 in.-lb

CO NTS:

TABLE II.

TEST: ARC 3.5 196 (TA9F)										DATE: JUNE 1974																						
DATA SET RUN NUMBER COLLATION SUMMARY										TEST RUN NUMBERS																						
DATA SET IDENTIFIER	CONFIGURATION	SCHD.		CONTROL DEFLECTION		NO. OF RUNS	PHI (°) (OR ALTERNATE INDEPENDENT VARIABLE)																									
		A	B	MAIN	R/N/L		0	45	90	135	180	225	270	315																		
REYMA1	TANK WITH	A' 0	10.4	1.16		8	18	17	16	15	14	13	12	11																		
GI	PROTUBERANCES	G	T	T		8	22	27	28	33	34	39	40	45																		
FI		F				8	23	26	57	32	35	38	41	44																		
EI		E				8	24	25	30	31	36	37	42	43																		
CI	Y	C' Y	Y	Y	Y	8	3	4	5	6	7	8	9	10																		
REYMA2	BASIC TANK	A' 0	10.4	1.16		1	1																									
G2		G	T	T	T	1	21																									
F2		F				1	19																									
E2		E				1	20																									
C2	Y	C' Y	Y	Y	Y	1	2																									
REYMA3	TANK WITH	A' 0	5.3	3.81		1																										
G3	PROTUBERANCES	G	T	T	T	1									54																	
F3		F				1									48																	
E3		E				1									49																	
C3	Y	C' Y	Y	Y	Y	1									52																	
															53																	
							7	13	19	25	31	37	43	49	55	61	67	73	76													
							COEFFICIENTS														IDVAR (1)				IDVAR (2)				NDV			
							SCHEDULES																									
							REYMA1, C1, A2, C2, A'3, C3, A4, AND A5 ONLY																									
							ALPHA																									

TABLE II.

DATA SET RUN NUMBER COLLATION SUMMARY										DATE: JUNE 1974									
DATA SET IDENTIFIER		CONFIGURATION		SCMD.		CONTROL DEFLECTION		NO. OF RUNS		PMI (0) (OR ALTERNATE INDEPENDENT VARIABLE)									
				A' B		N _A N _B L				0 45 90 135 180 225 270 315									
REYMA4		TANK WITH		A' 0		10.4 0.34		1											
T G4		PROTUBERANCES		G T		T T		1											
F4		T		F T		T T		1											
REYMA5		TANK WITH		A' 0		10.4 1.74		1											
T G5		PROTUBERANCES		G T		T T		1											
F5		T		F T		T T		1											
REYMA6		TANK WITH PROTUBERANCES		A' 0		10.4 0.34		1											
T G6		T		G T		T T		1											
REYMA7		TANK WITH PROTUBERANCES		A' 0		10.4 1.16		1											
T G7		T		G T		T T		1											

COEFFICIENTS

CO OR B

SCHEDULES

IDVAR (1)

IDVAR (2)

NDV

TABLE III.
DEL DIMENSIO DATA

DEL CO ONENT: EXTERNAL TANK (ET)

GENERAL DESCRIPTION: EXTERNAL OXYGEN-HYDROGEN TANK (MACHINED IN SIX PARTS)

MODEL SCALE = .006

DRAWING NUMBER: VJ 78-000062B

	RE	A
DIMENSIONS:	EL	MODEL S E
Length, IN. (NOSE @ $X_T=298$)	<u>1883.8</u>	<u>11.303 IN.</u>
Max. Width, IN. (DIA)	330.2	1.98 IN.
x. Depth		
Fineness Ratio	<u>5.71</u>	<u>5.71</u>
Area		
x. Cross-Sectional		<u>3.08 IN.²</u>
Planform		
Wetted		
Base		<u>3.08 IN.²</u>

TABLE III. (Continued)

L COMPONENT: ATTACH STRUCTURE

REAL DESCRIPTION: FORWARD ORBITER/ET - ATTACH STRUCTURE

SCALE = .006

DRAWING NUMBER: VI 78-000062B

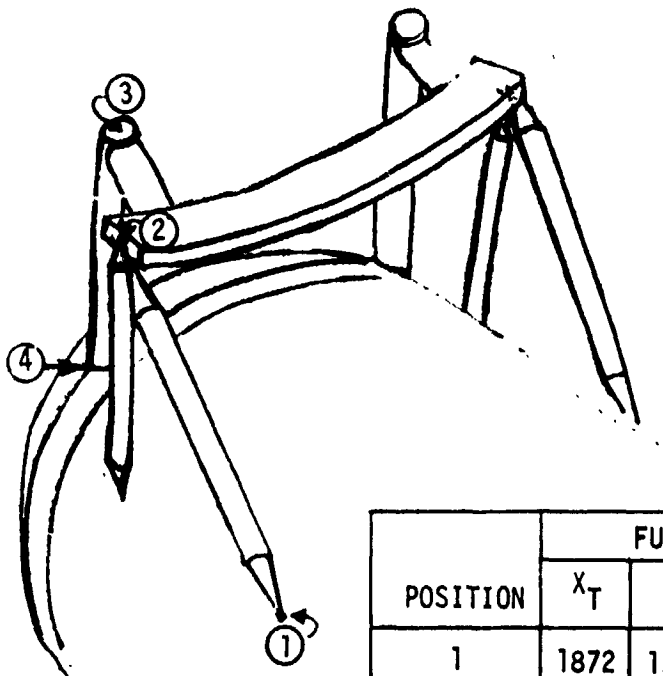
DIMENSIONS:	THEORETICAL		A	AL MEASURED
	FULL-SCALE	MODEL SCALE		MODEL SCALE
LOCATION OF CENTER				
X_T	<u>1129.9</u>	<u>6.78</u>		
Y_T	<u>0.0</u>	<u>0.0</u>		
Z_T	<u>214.0</u>	1.284		
AN	MADE BY MEMBERS =	<u>92°40'</u>	92°40'	
DIAMETER OF MEMBERS =	<u>5.67</u>	.034		

TABLE III. (Continued)

MODEL COMPONENT: ATTACH STRUCTURE

GENERAL DESCRIPTION: REAR ORBITER ET ATTACH STRUCTURE. STRUCTURE IS MADE WITH BASE (PART NO. 80M42703).

DRAWING NUMBER: VL78-000062B and SK-RL 21974



POSITION	FULL SCALE			MODEL SCALE		
	X _T	Y _T	Z _T	X _T	Y _T	Z _T
1	1872	125.68	115.50	11.232	.754	.693
2	2058	96.50	203.56	12.348	.579	1.221
3	2088	70.0	203.56	12.528	.42	1.221
4	2088	70.0	100.00	12.528	.42	.6

*FOR DETAIL MODEL DIMENSIONS SEE FIGURE 2g.

TABLE III. (Continued)

MODEL COMPONENT: CENTER BODY AND BASE PROTUBERANCE NUMBER 1GENERAL DESCRIPTION: LH₂ PRESSURE LINE AND ELECTRICAL CONDUIT

MODEL SCALE = .006

DRAWING NUMBER: VL78-000062B

<u>DIMENSIONS:</u> (INCHES)	THEORETICAL		ACTUAL MEASURED
	FULL-SCALE	<u>MODEL SCALE</u>	<u>MODEL SCALE</u>
HEIGHT	<u>5.0</u>	.03	<u> </u>
WIDTH	<u>10.0</u>	<u>.06</u>	<u> </u>
X _T (BEGINNING)	1040 <u> </u>	6.24	<u> </u>
X _T (ENDING)	2052	<u>12.312</u>	<u> </u>
RADIAL POSITION	33°45'	<u>-35°9'</u>	<u> </u>

TABLE III. (Continued)

MODEL COMPONENT: NOSE AND NOSE PLUG PROTUBERANCE

GENERAL DESCRIPTION: LO₂ PRESSURE LINE AND ELECTRICAL CONDUIT ALONG NOSE

MODEL SCALE = .006

DRAWING NUMBER: VL78-000062B

DIMENSIONS: (INCHES)	THEORETICAL		A	AL	SURED
	FULL-SCALE	MODEL SCALE	MODEL SCALE		
HEIGHT	6.67	.04			
WIDTH	10.00	.06			
X _T (BEGINNING)	<u>360.92</u>	2.165			
X _T (ENDING)	4.805	800.92			
RADIAL POSITION	<u>33.45°</u>	<u>32°42'</u>			

TABLE III. (Continued)

MODEL COMPONENT: CENTER BODY AND BASE PROTUBERANCE NUMBER 2

GENERAL DESCRIPTION: LO₂ FEED LINE

MODEL SCALE = .006

DRAWING NUMBER: VL78-000062B

DIMENSIONS: (INCHES)	<u>THEORETICAL</u>		ACTUAL MEASURED
	FULL-SCALE	MODEL SCALE	MODEL SCALE
HEIGHT	<u>16.67</u>	<u>.1</u>	
WIDTH	<u>16.67</u>	<u>.1</u>	
X _T (BEGINNING)	<u>1040</u>	<u>6.24</u>	
X _T (ENDING)	<u>2052</u>	12.312	
RADIAL POSITION	<u>23°24'</u>	23°24'	
	<u> </u>		
	<u> </u>		

TABLE III. (Continued)

MODEL COMPONENT: CENTER BODY AND BASE PROTUBE CE NUMBER 3

GENERAL DESCRIPTION: ELECTRICAL CONDUIT, LO₂ RECIRCULATION LINE AND LO₂
PRESSURE LINE

MODEL SCALE = .006

DRAWING NUMBER: VL78-000062B

DIMENSIONS: (INCHES)	THEORETICAL		ACTUAL MEASURED
	FULL-SCALE	MODEL SCALE	MODEL SCALE
HEIGHT	<u>6.67</u>	<u>.040</u>	
WIDTH	<u>19.0</u>	.114	
X _T (BEGINNING)	1040	6.24	
X _T (ENDING)	2052	12.312	<u> </u>
RADIAL POSITION	33°45'	34°16'	.

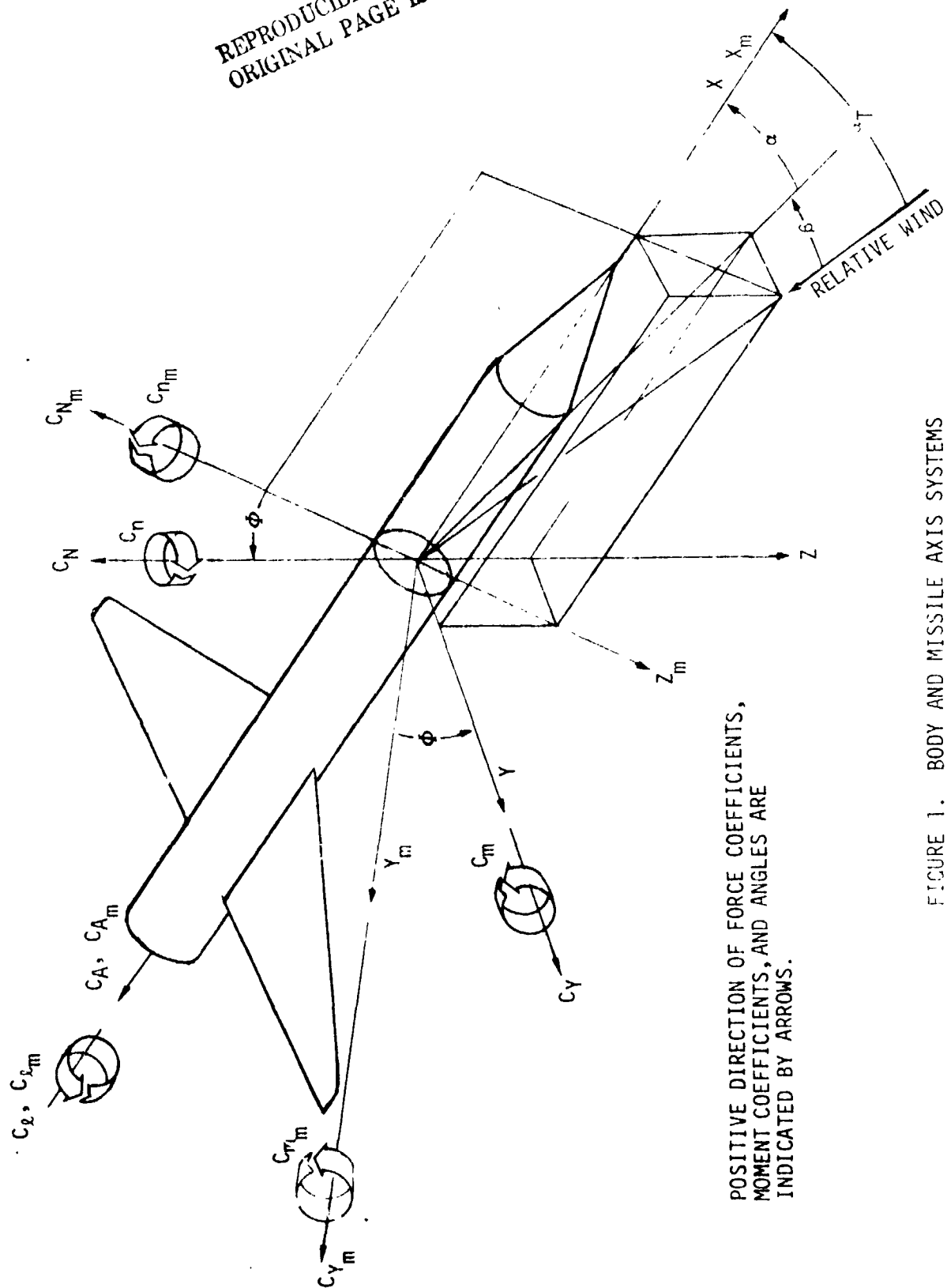
TABLE III. (Continued)

MODEL COMPONENT: ATTACH STRUCTUREGENERAL DESCRIPTION: AFT SRB/ET ATTACH STRUCTURE (3 MEMBERS, ET PORTION TESTED ONLY)MODEL SCALE = .006

DRAWING NUMBER: VL78-000062B

DIMENSIONS: (INCHES)	THEORETICAL		ACTUAL <u>MEASURED</u>
	FULL-SCALE	MODEL SCALE	MODEL SCALE
LOWER HORIZONTAL MEMBER			
X _T	<u>2052</u>	<u>12.312</u>	
Y _T	<u>+161.32</u>	<u>+.968</u>	
Z _T	<u>-57</u>	<u>-.342</u>	
DIAMETER	<u>5.5</u>	<u>.033</u>	
UPPER HORIZONTAL MEMBER			
X _T	2052	12.312	
Y _T	+161.32	+.968	
Z _T	<u>57</u>	<u>.342</u>	
DIAMETER	<u>5.5</u>	<u>.033</u>	
UPPER VERTICAL MEMBER			
X _T	2052	12.312	
Y _T	<u>+161.32</u>	<u>+.968</u>	
Z _T	57	.342	
DIAMETER	5.5	.033	

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POSITIVE DIRECTION OF FORCE COEFFICIENTS,
MOMENT COEFFICIENTS, AND ANGLES ARE
INDICATED BY ARROWS.

FIGURE 1. BODY AND MISSILE AXIS SYSTEMS

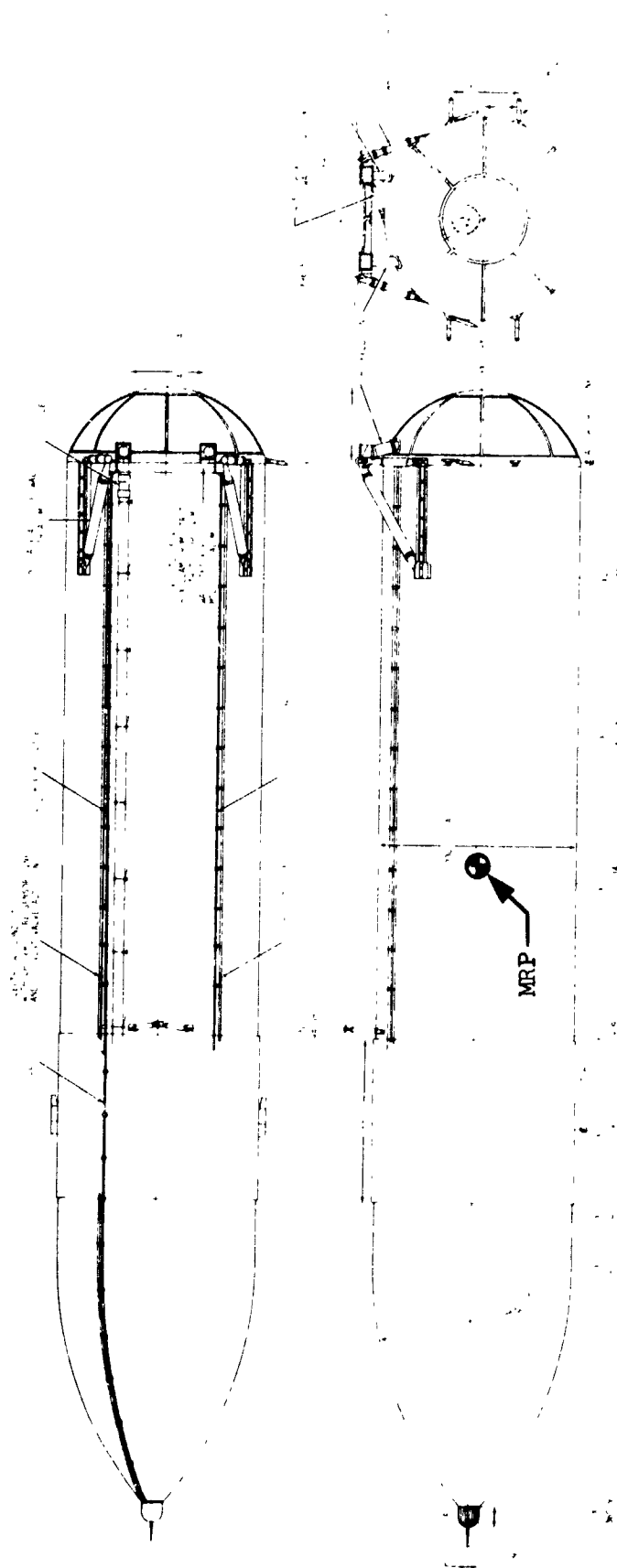


FIGURE 2a. CONFIGURATI DEFINITION FROM ROCKWELL DRAWING VL78-000062B

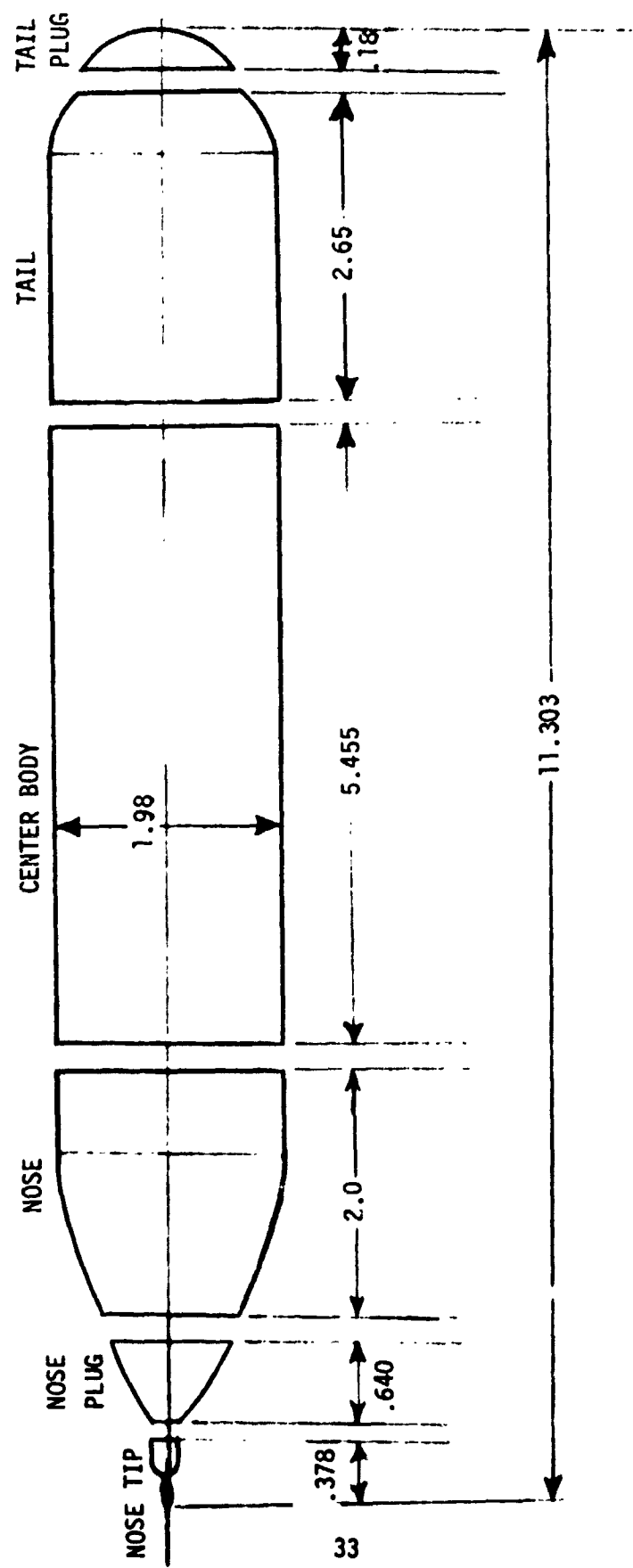
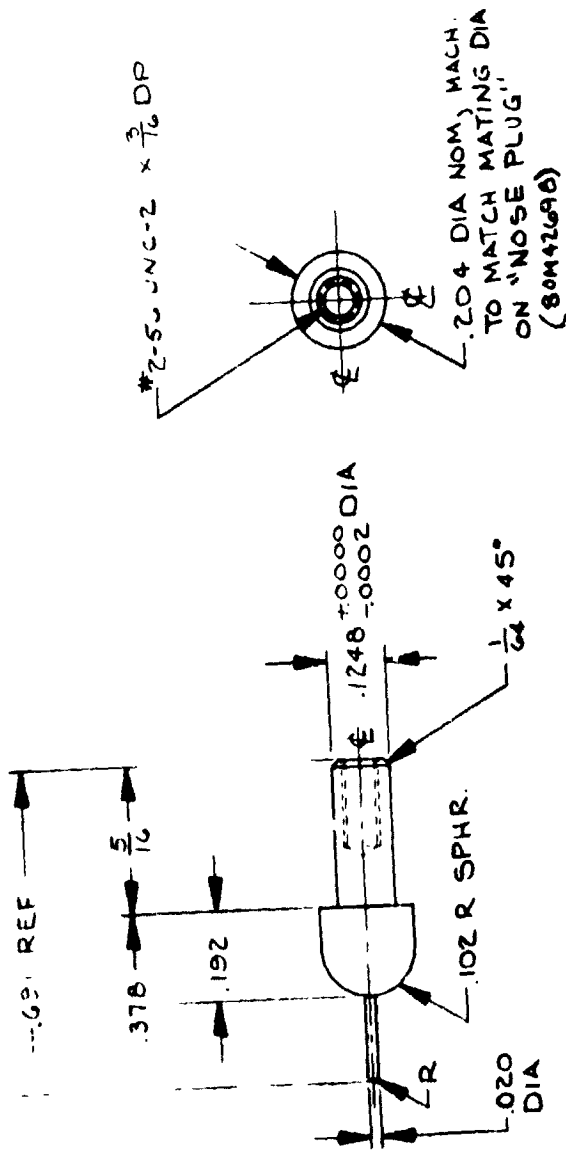


FIGURE 2b. SIC EL PARTS AND DI NSI S

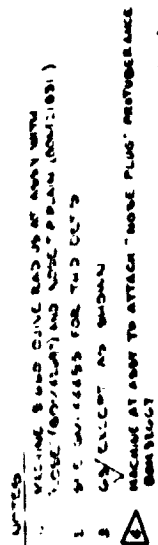


NOTES:

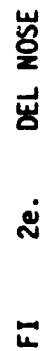
1. 32/
2. SEE GM44455 FOR THD DET'S.

FI 2c. L NOSE TIP

13



13 2d. L 55 PL



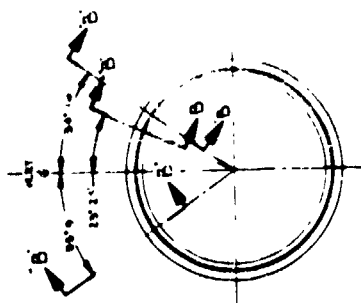
NOTES:

MSC 67-07208/B:


2 352 3M4J455 FOR 140 DO -

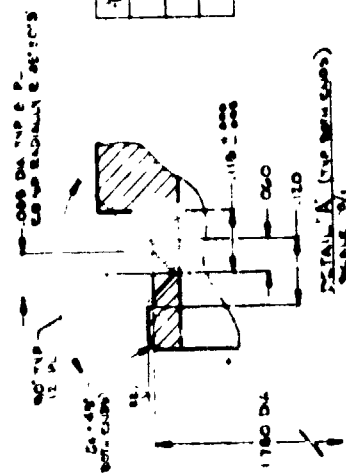
NAME SUBJECT 2 274 000
WITH "MOSE RUG" BUREAU 2 274 000
TIP (F.A.N.) 3000 000

SECRET
PROVIDENCE



(2000-2001) 100% TO 100% FROM 100% TO 100% Δ 1
 100% TO 100% / 100% 1

LOC. ON PLATE FROM LEFT	"F" THREAD	WATING PART 
95° 1' CW	30 UNH	CLAYE BODY PROTRUSANCE ¹ (BODY-PLUG)
2° 24 CW	1.00 UNH	CLAYE BODY PROTRUSANCE ² (BODY-PLUG)
96° 14 CW	.60 UNH	CLAYE BODY PROTRUSANCE ³ (BODY-PLUG)



FI 2f. L C ER Y FOR SE D TAIL

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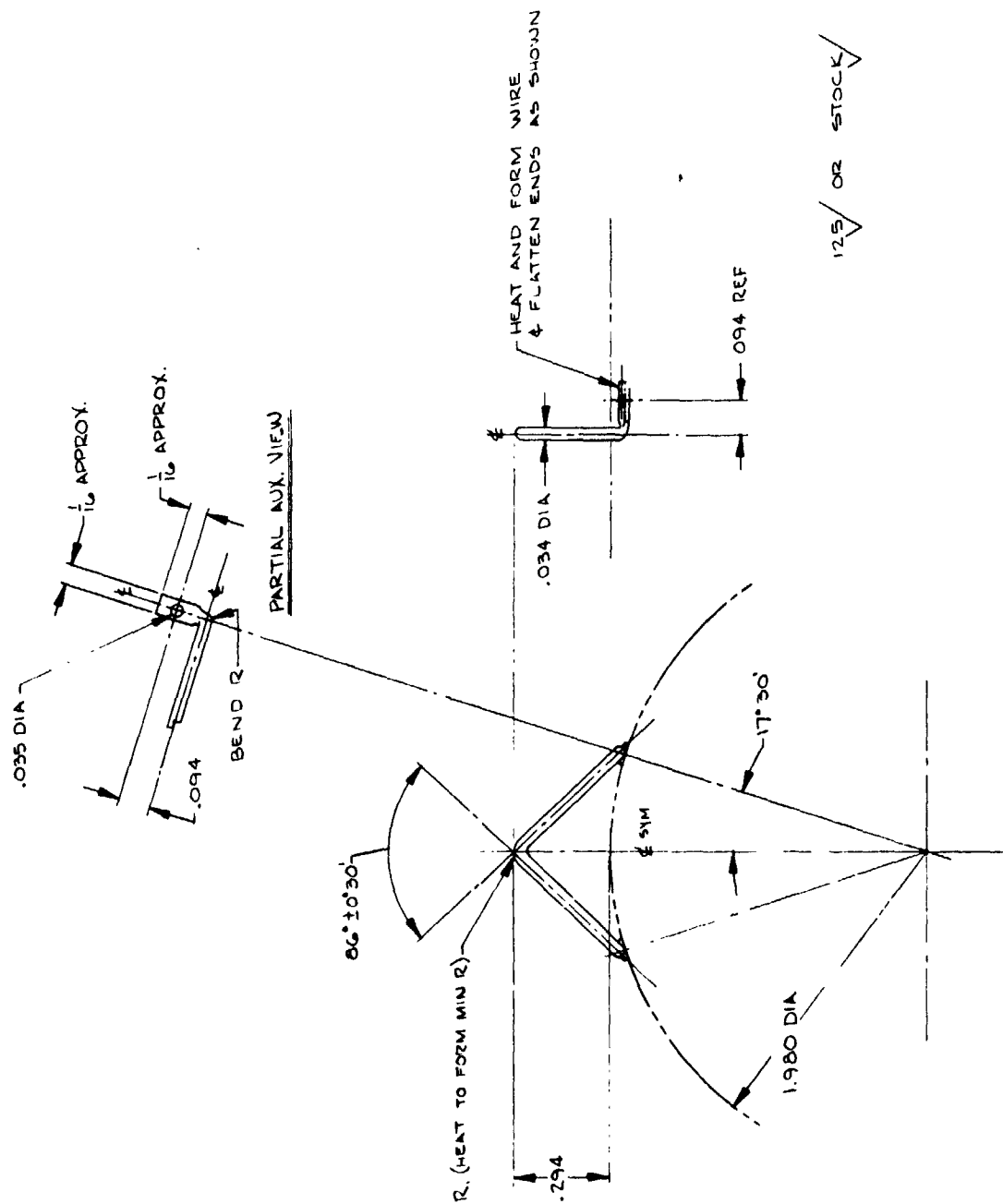


FIGURE 2j. FOR RD ORBITER ATTACH HARDWARE

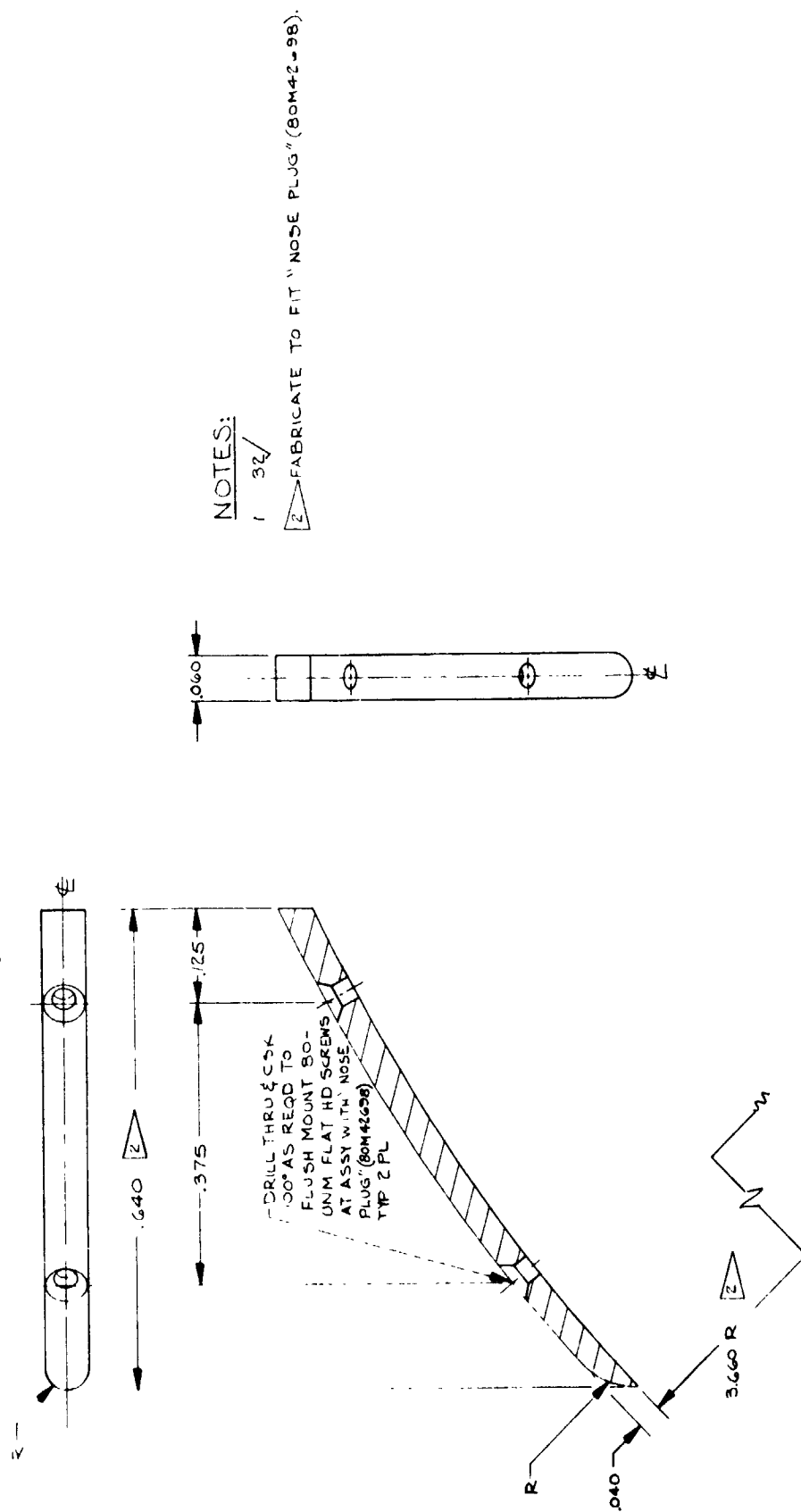


FIGURE 2k. ELECTRICAL CONDUIT NOSE PLUG PROTUBERANCE



NOTES:

1. 3.660 R

FABRICATE TO FIT NOSE (80M42697).

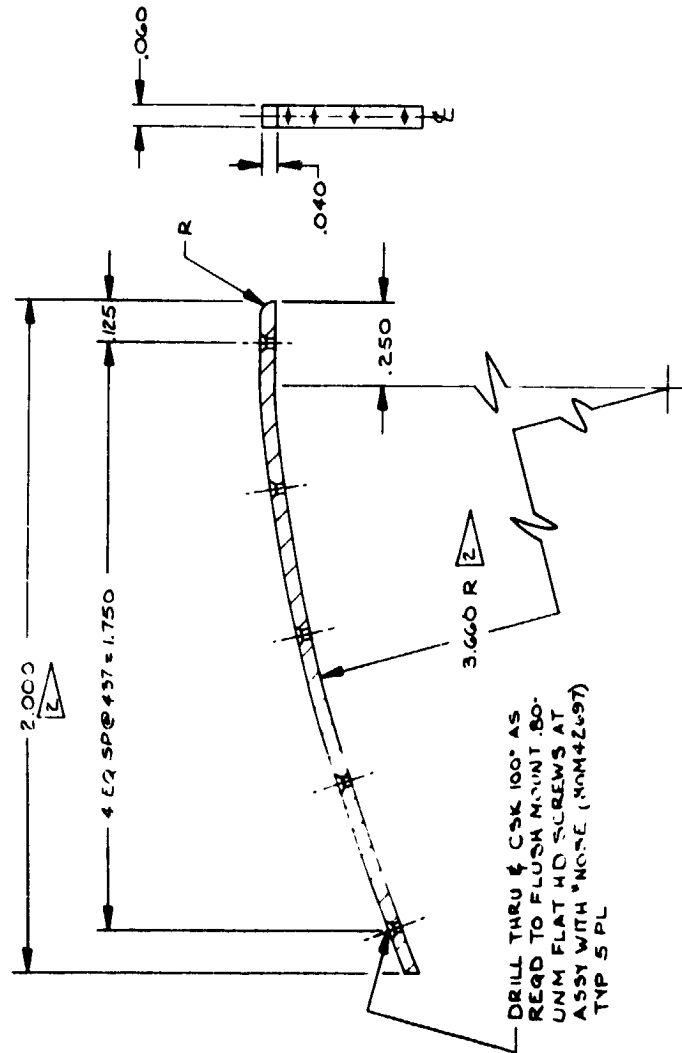


FIGURE 21. ELECTRICAL CONDUIT NOSE PROTUBE CE

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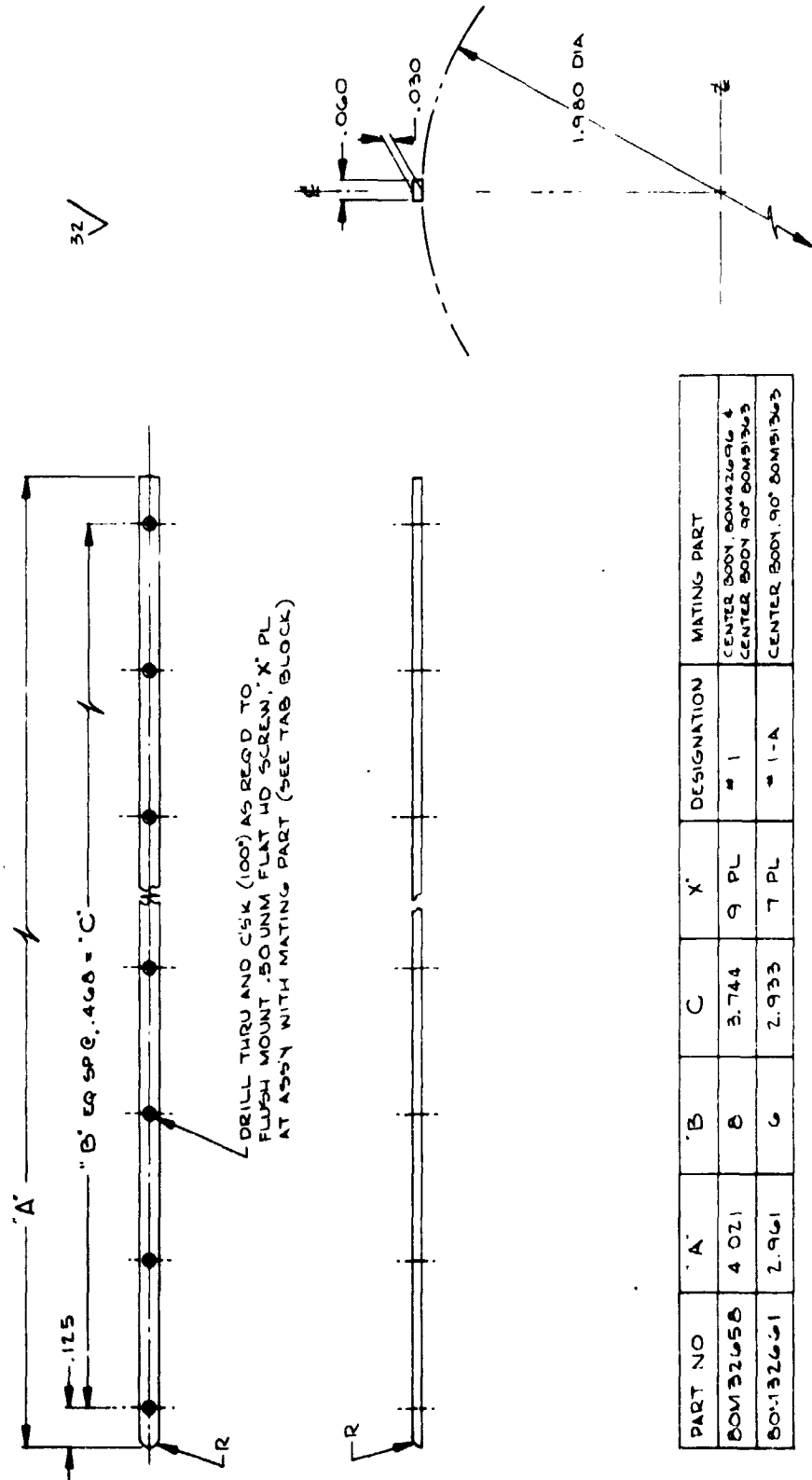


FIGURE 2m. LH2 PRESSURE LINE PROTUBERANCE

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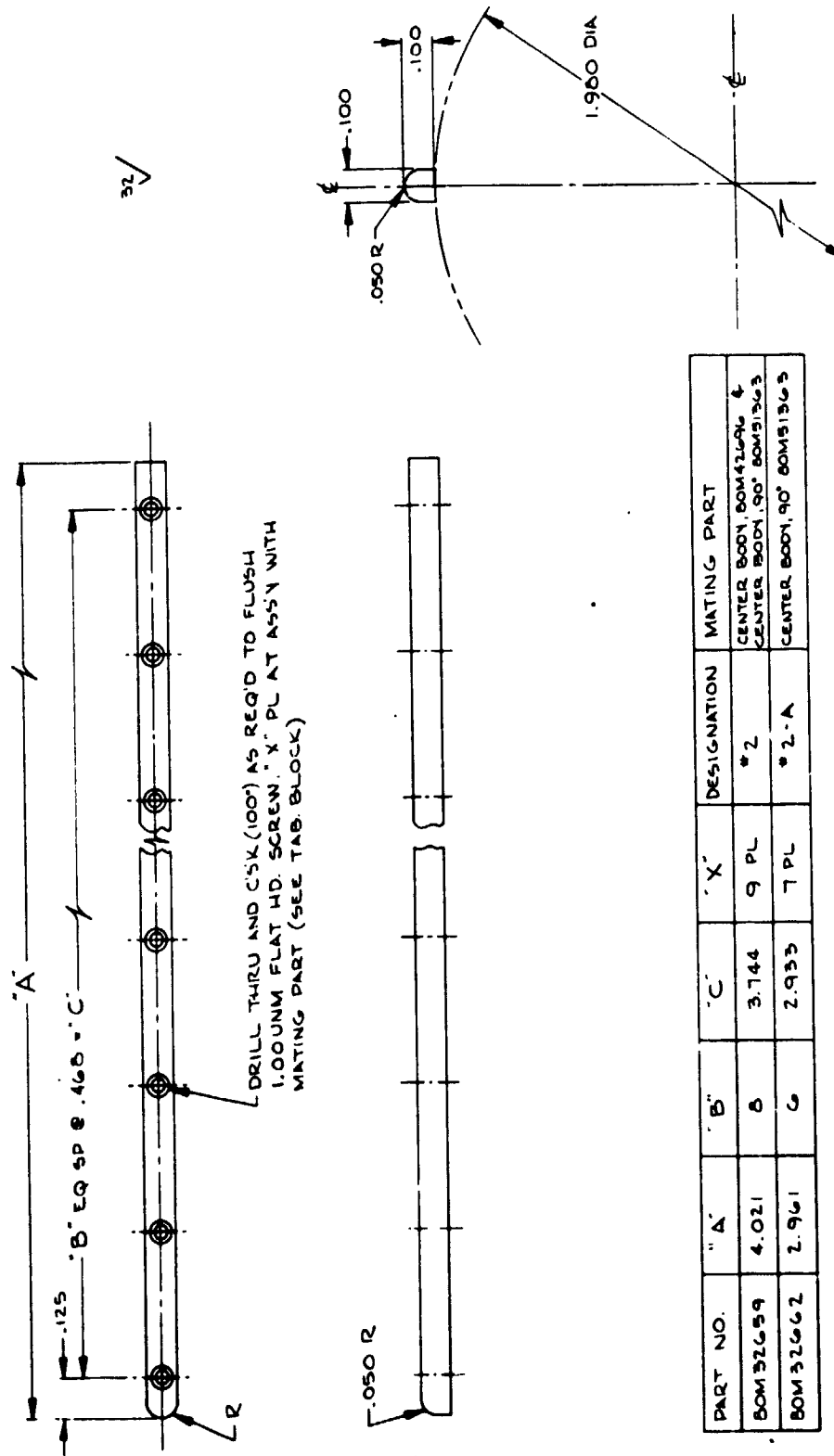
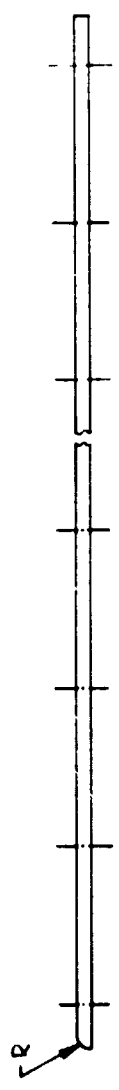
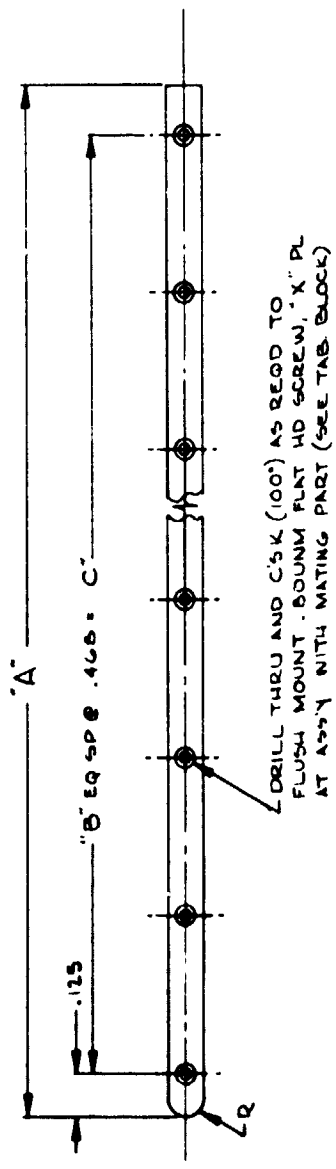
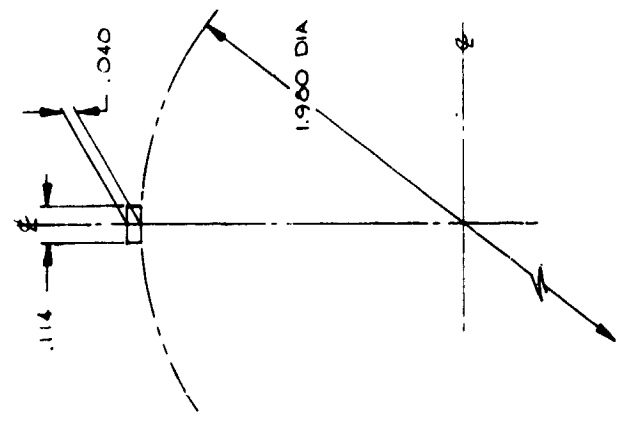


FIGURE 2n. LO₂ FEED LINE PROTURE CE



PART NO.	"A"	"B"	"C"	"X"	DESIGNATION	MATING PART
80M32660	4.021	6	3.744	9 PL	# 3	CENTER BODY 80M42604 & CENTER BODY 90° 80M51363
80M32663	2.961	6	2.933	7 PL	# 3-A	CENTER BODY 90° 80M51363

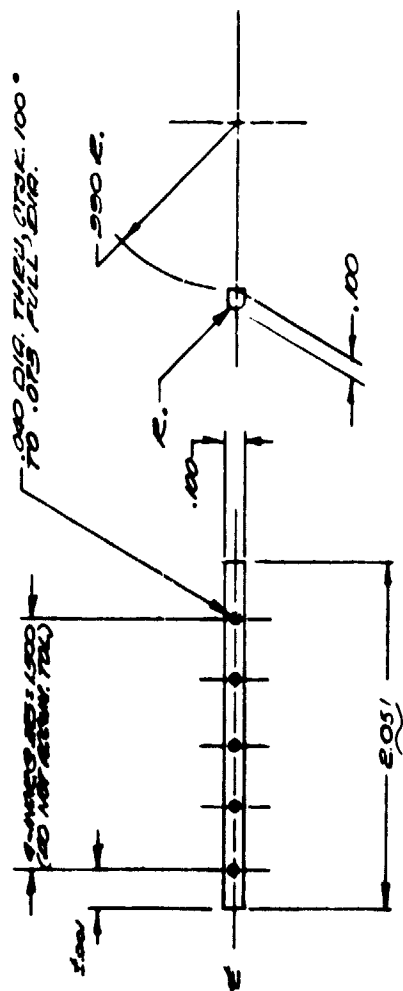
32/



ACT NO.	"A"	"B"	"C"	"D"	NO.
CONF-3000	.050	.050	.085	.060	1
CONF-3010	.050	.050	.057	.114	3

✓

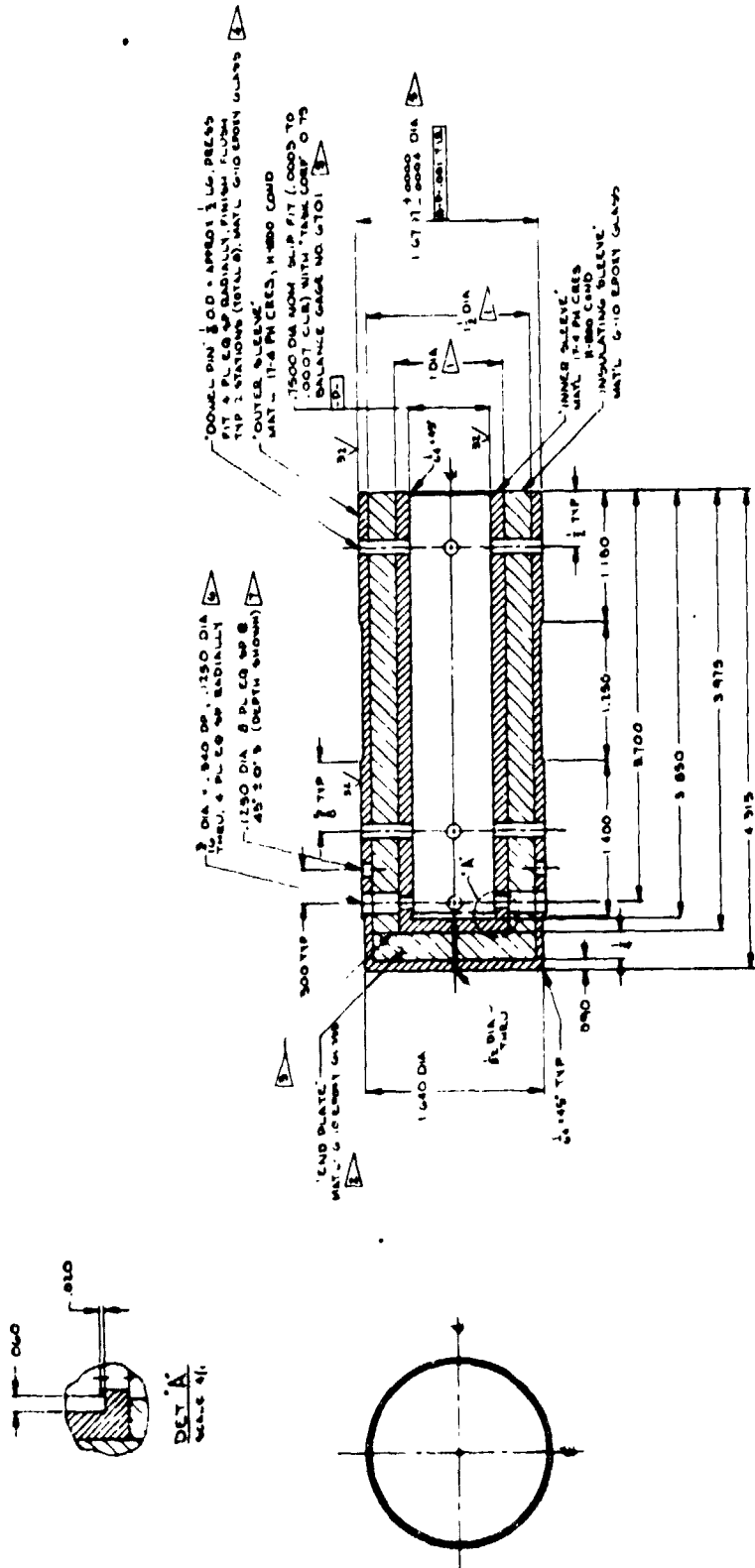
FI 2p. LH2 P S LINE P TUBE E D LO2 P SSURE LINE, CE
LO2 CIRCULATI LINE D ELECTRICAL C IT PROTUBE

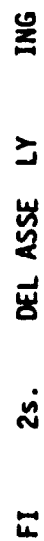


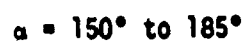
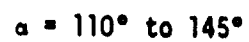
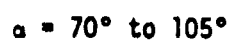
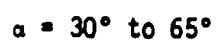
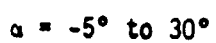
35

FI 2q. E P TION OF LO₂ FEED LINE PROTUBE CE

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[illegible]**FI 2r. INSULATING SLEEVE**





FI 2t. STRUT D L TING POSITIONS FOR LE-OF-ATTACK S



FIGURE 3a. TYPICAL TUNNEL INSTALLATION WITH MODEL MOUNTED FROM THE NOSE

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7. 11. 1964
S. 11. 1964

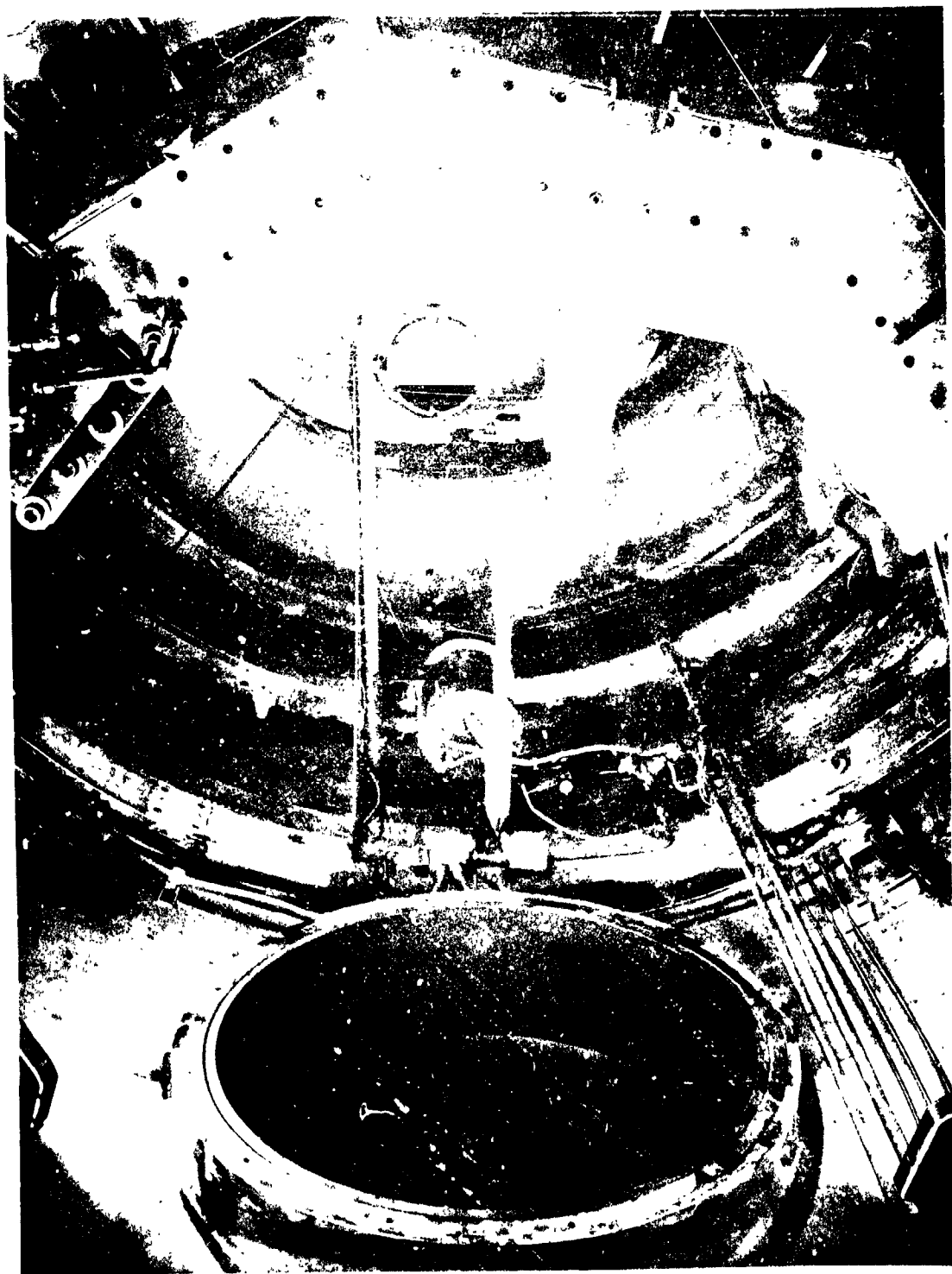


FIGURE 3b. TYPICAL TUNNEL INSTALLATION WITH MODEL MOUNTED FROM THE TAIL



FIGURE 3c. TYPICAL TUNNEL INSTALLATION WITH MODEL MOUNTED FROM THE SIDE

DATA FIGURES

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (CEYMO1)

PH: .
 45: .
 90: .
 135: .
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 225: .
 270: .
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ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO1)

PHI
45:
90:
135:
◇
□
△

P TRIC VALUES 1.160

REFERENCE INF TION
594.1 SQ.FT.
330. IN.
330. IN.
1406. IN.
XREF XREF XREF XREF
YREF YREF YREF YREF
SCALE :

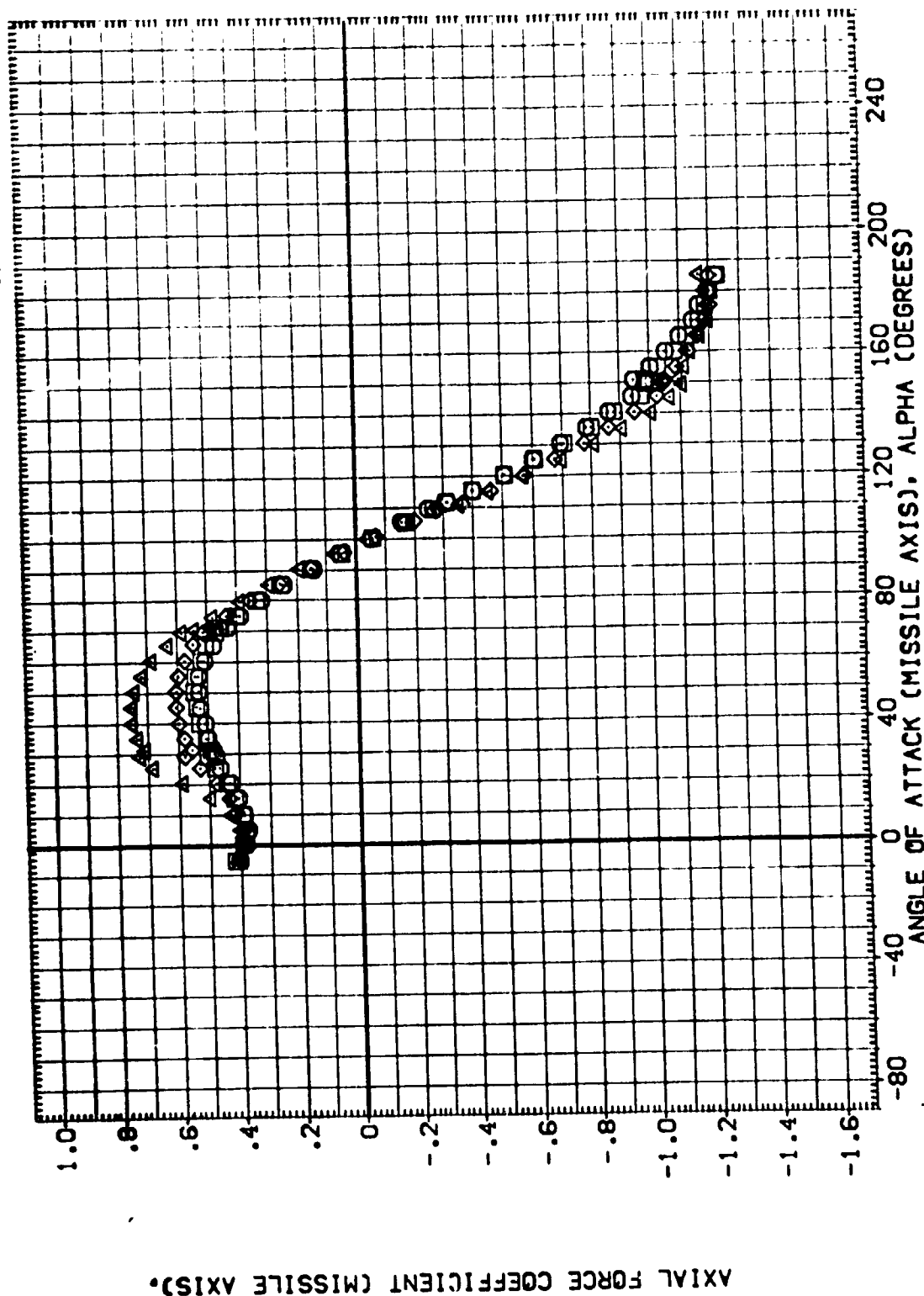


FIG. 4 COEFFICIENTS VERS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROT ERANCES) (CEYMO1)

PHI 160. 225. 270. 315.
 TRIC V 10.400 1.160
 LREF 330.
 BREF 330.
 XPRP 1406.
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 TIDN 50.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

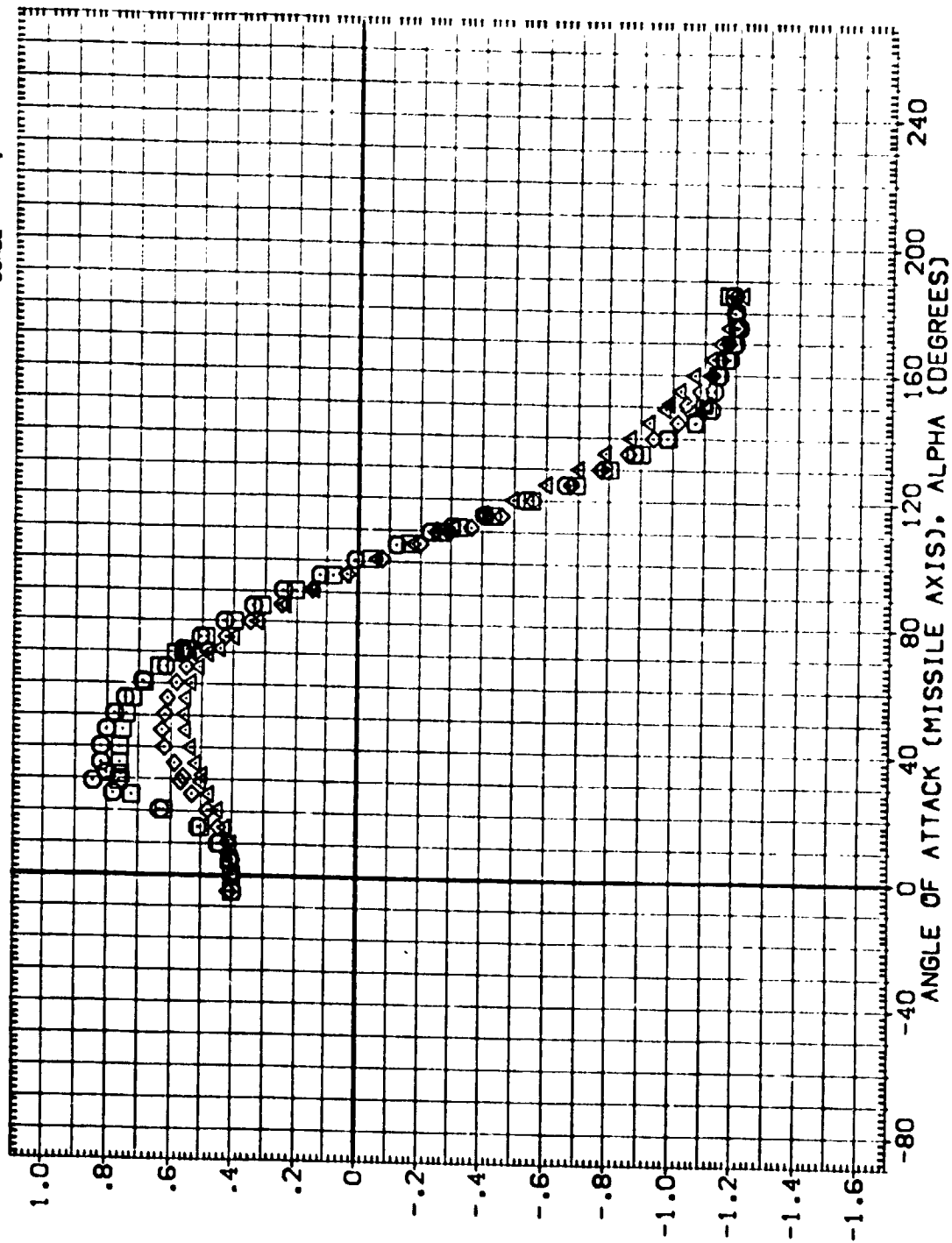


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO1)

P 10.400 TRIC VALUES 1.180
 PHI 45: 50: 135:
 594.1 59.47.
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 330. 330.
 1406. 1406.
 LREF XMRP
 SCALE
 IN. IN. XT
 IN. YZ
 IN. ZT

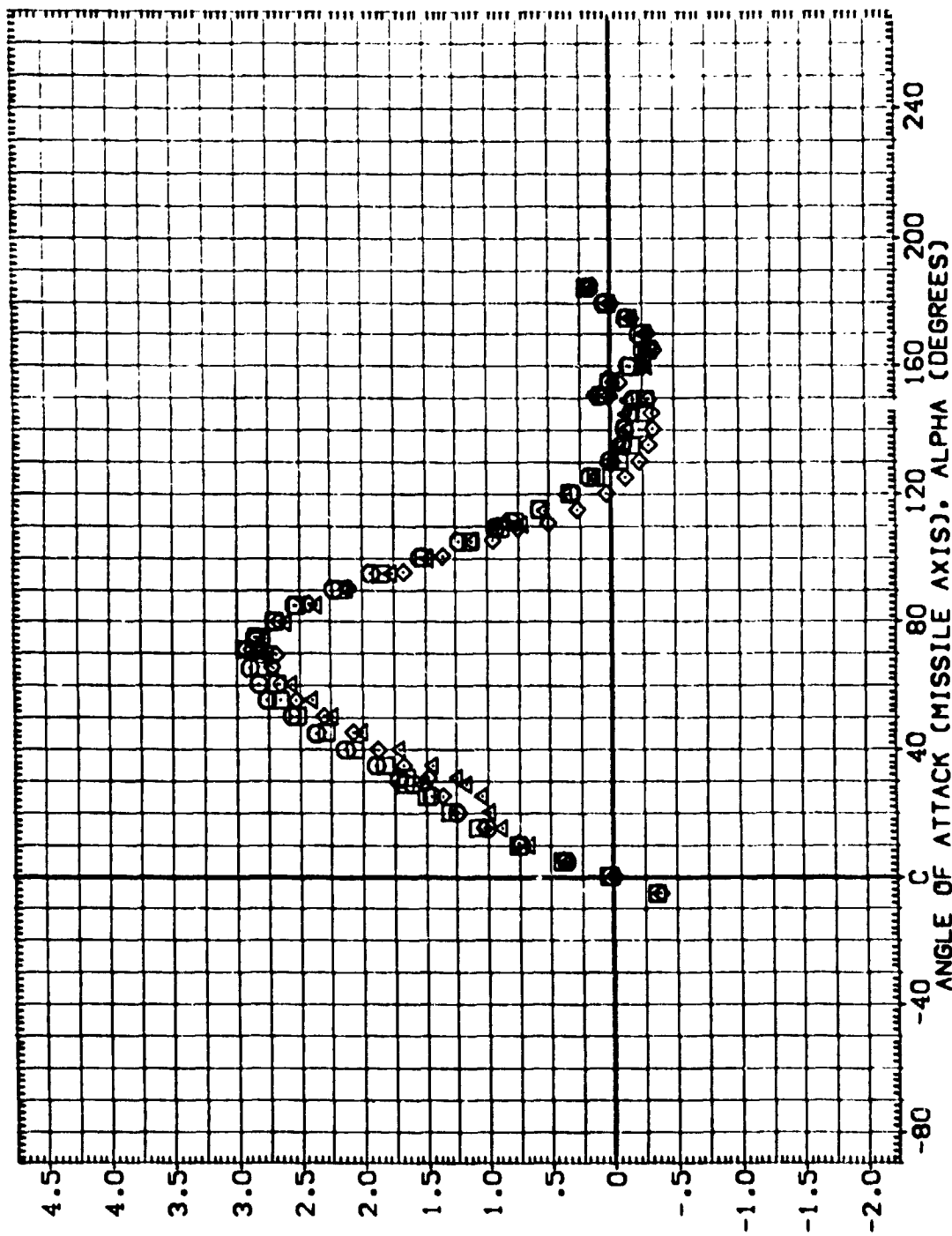


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

PHI	IC V	REF	ION
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.		330.	33.0
315.		1406.	140.6
		.	.

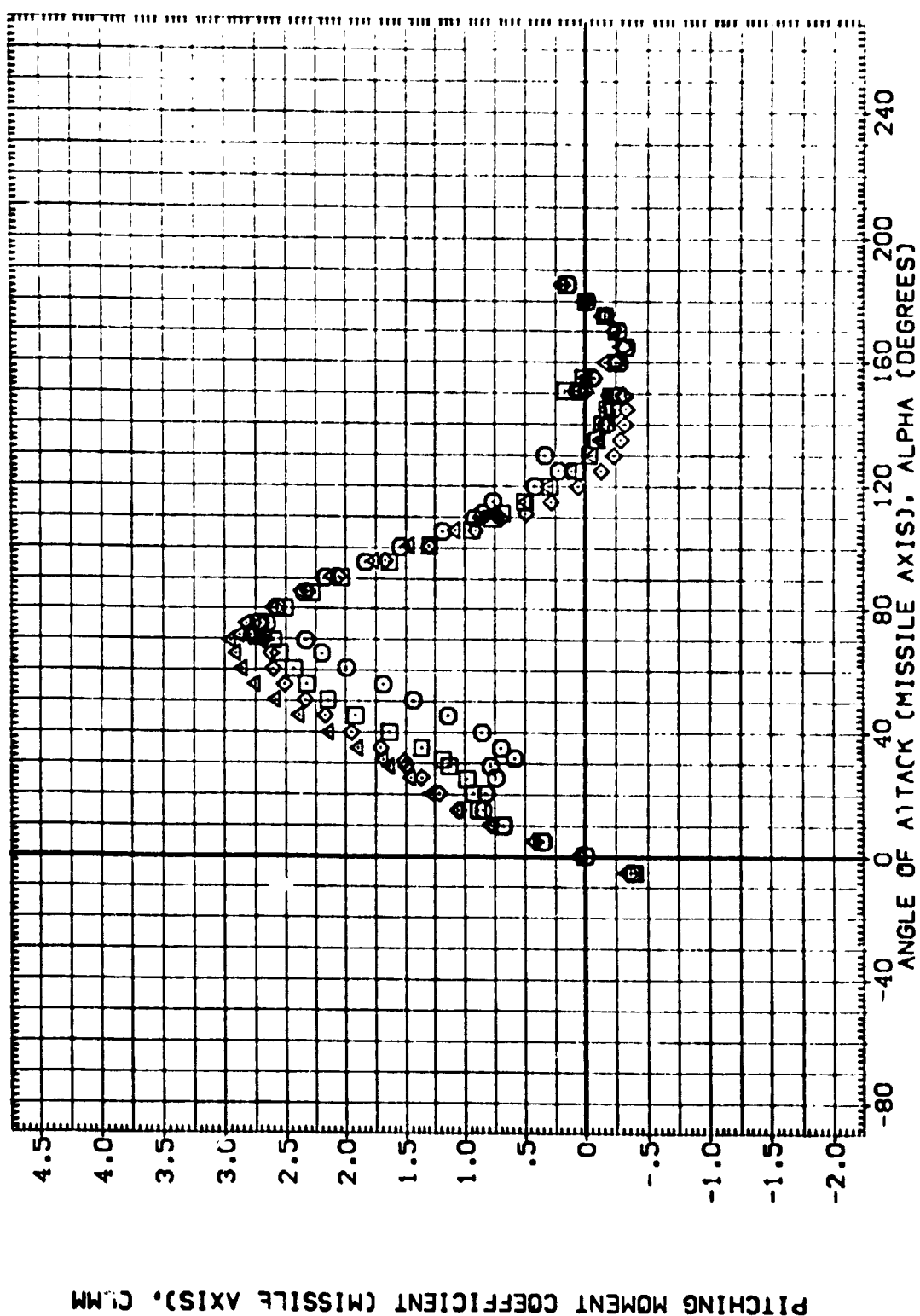


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

PHI	P	TRIC V	RENCE IN	TION
10.400	1.160	SREF	594.1	50.FT.
45:		LBREF	330:	IN.
50:		BRF	330:	IN.
135:		XMRP	1406:	IN.XT
				IN.YT
				IN.ZT
		SCALE		

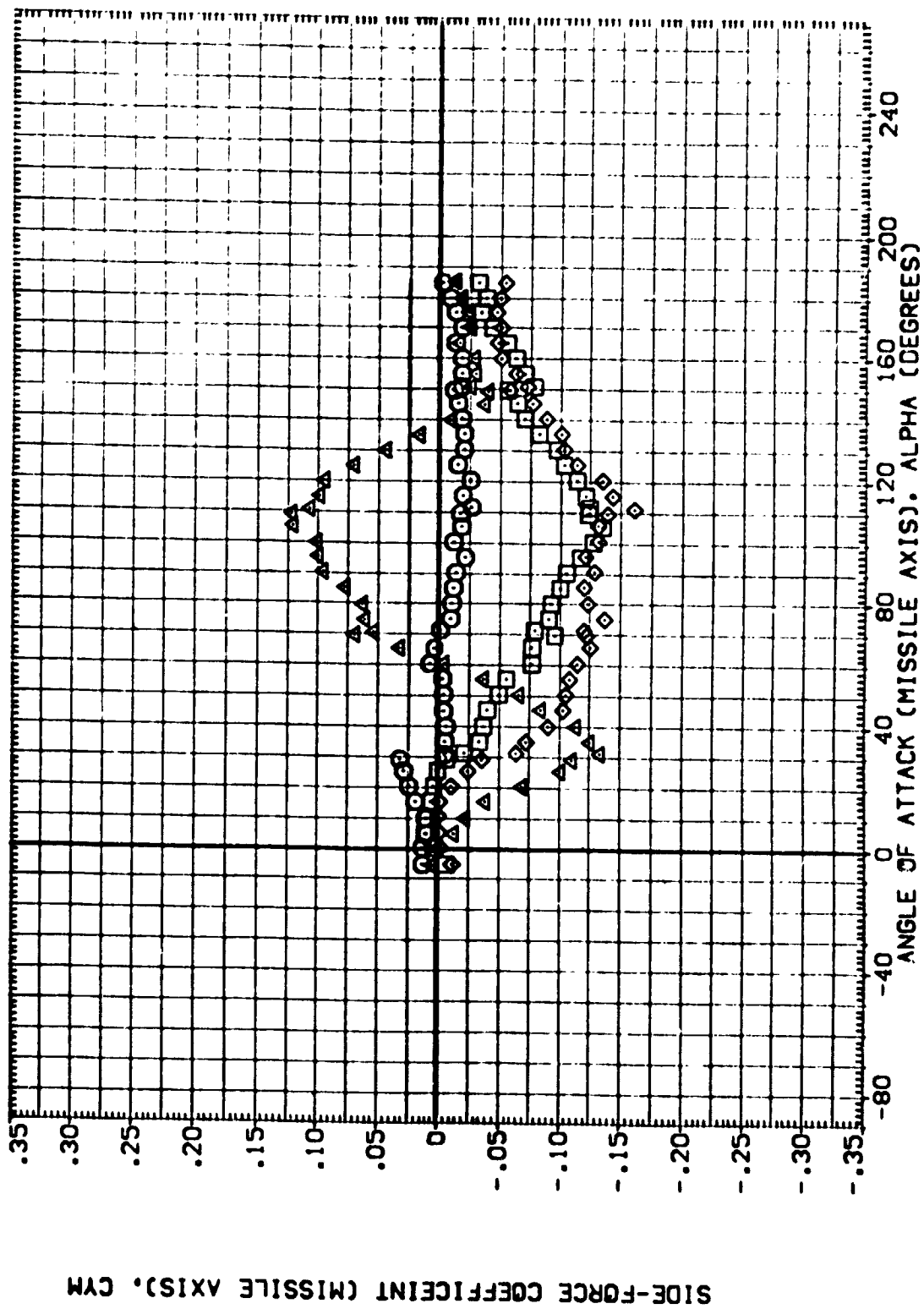


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

A 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO1)

PHI	MACA	TRIC V	1.160	INF	594.1	YION
160.	10.			330.	90.FT.	
				F	IN.	
315.				XMRP	1406.	IN.XY
						IN.VY
						IN.ZY

SCALE

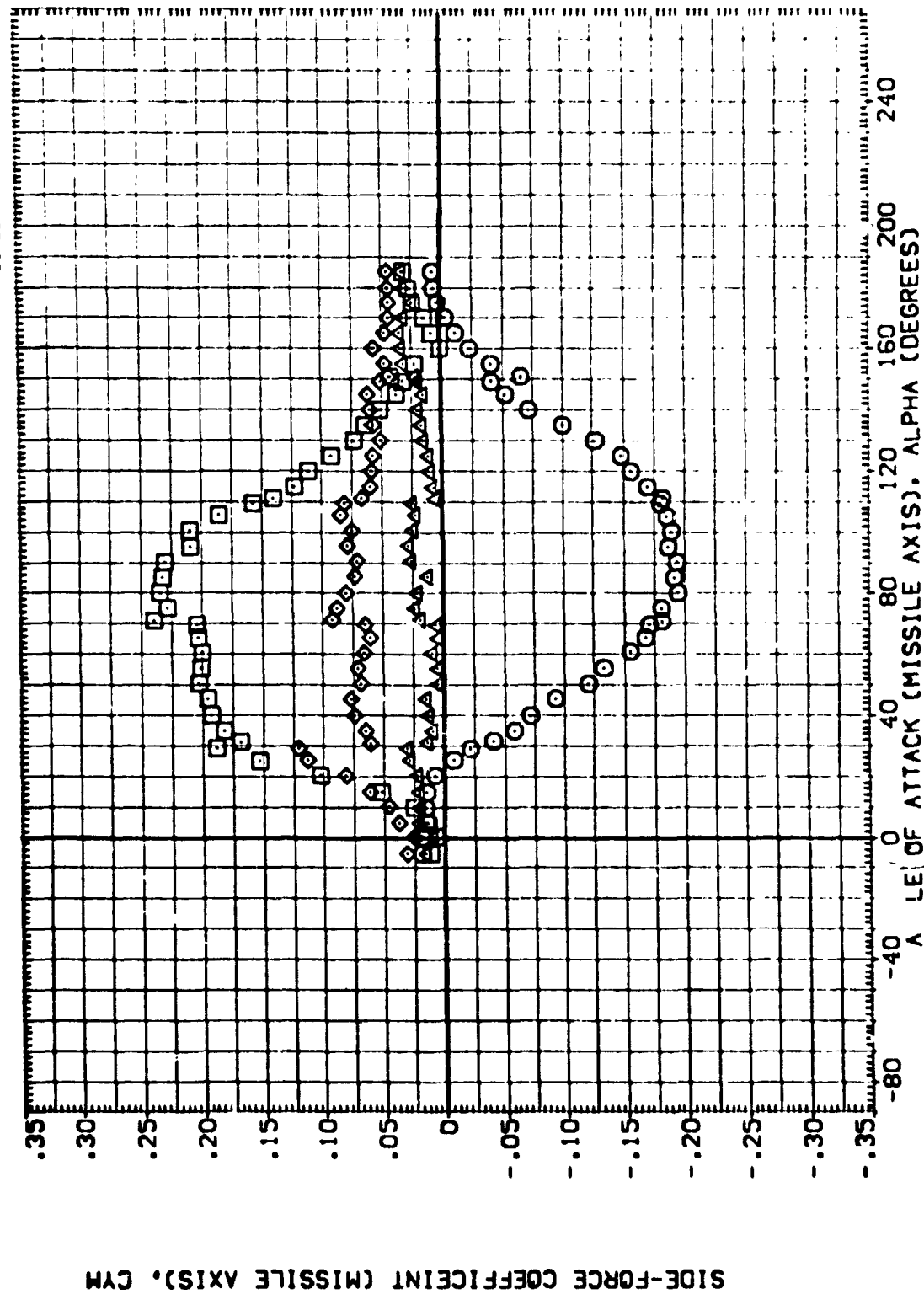


FIG. 4 COEFFICIENTS VE US ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO!)

P	TRIC V	\$
10.400	MVL	1.160
<hr/>		
RNI	.	
45.		
99.		
135.		
<hr/>		
SRECE INF		TION
594.1		50.FT.
LREF		N.
330.		N.
BREF		N.
330.		N.XT
1406.		N.YT
XRRP		N.ZY
YRRP		
ZRRP		
SCALE		

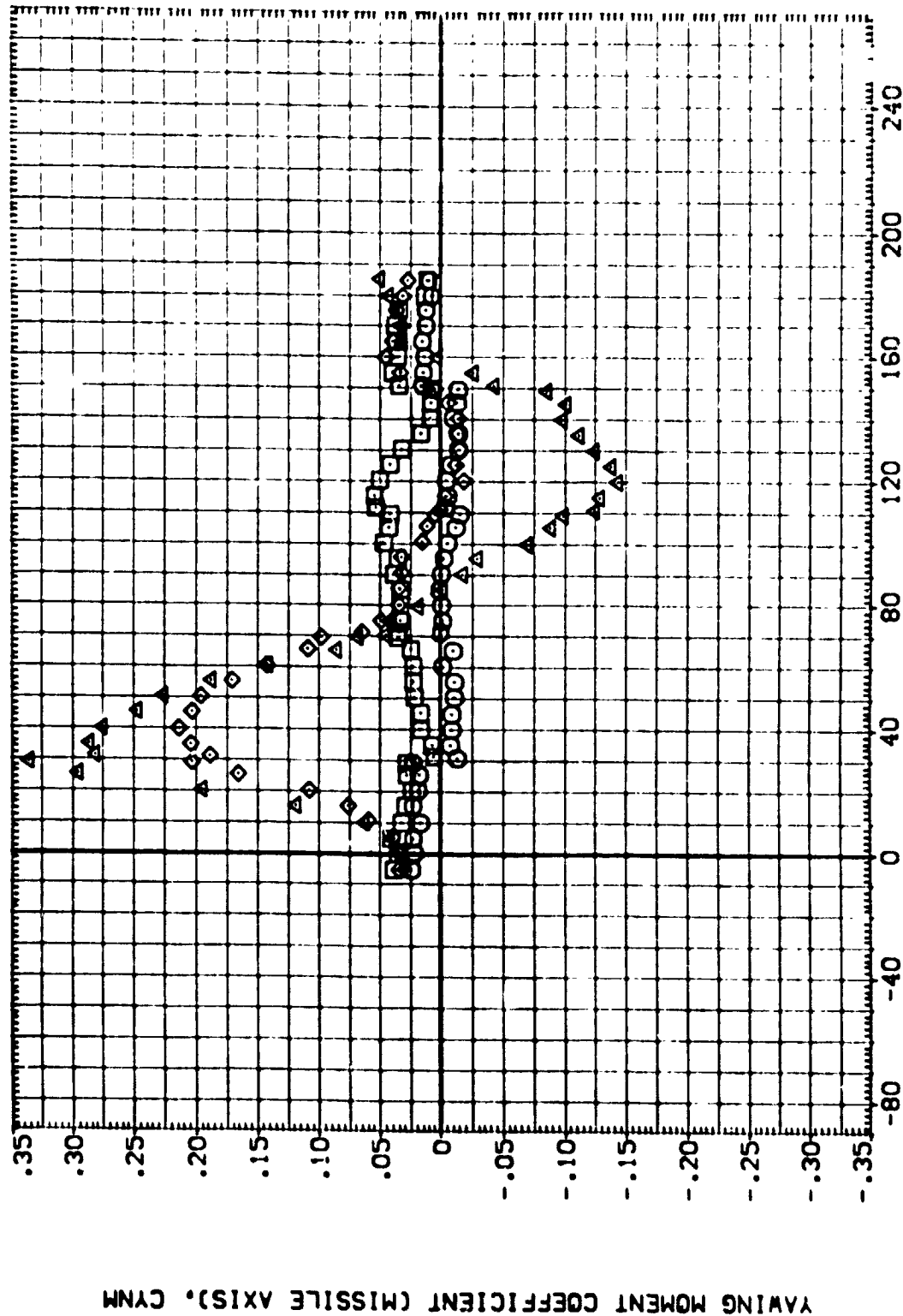


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

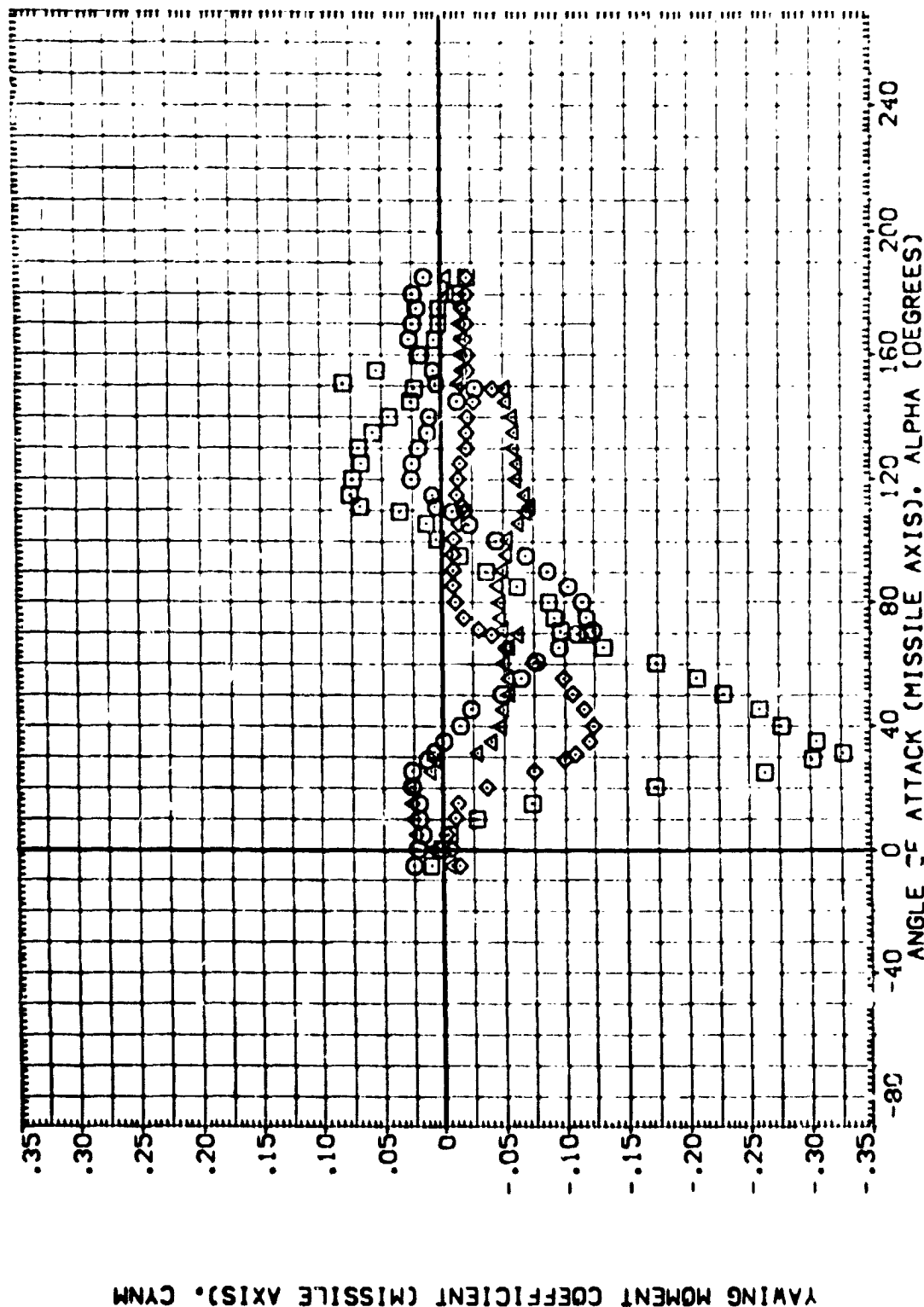
[illegible]

FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (CFYMO1)

PH1
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 90.000
 135.000

PARAMETRIC VALUES
 10.400 RN/L 1.160

REFERENCE INFORMATION
 SREF 594.1370 50.FT.
 LREF 333 IN.
 BREF 330 IN.
 XMRP 1406 IN.
 YMRP IN.
 ZMRP IN.
 SCALE IN.

○ □ ◇ △

ROLLING MOMENT COEFFICIENT (MISSILE AXIS), CBL

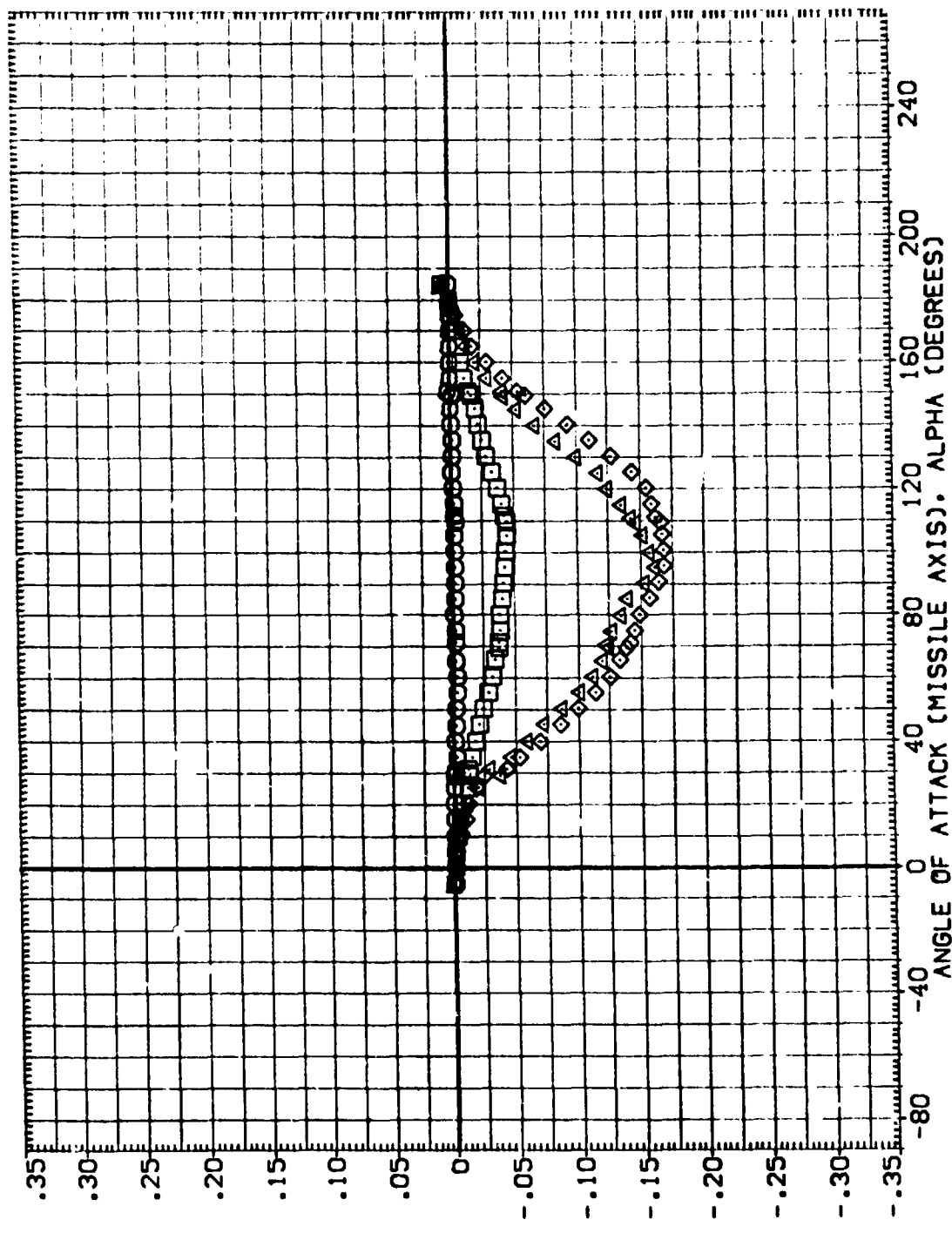


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

(C E Y M O I)

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270.000			BREF 330.	IN.
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			YMRP .	IN.YT
			ZMRP .	IN.ZT
			SCALE .	

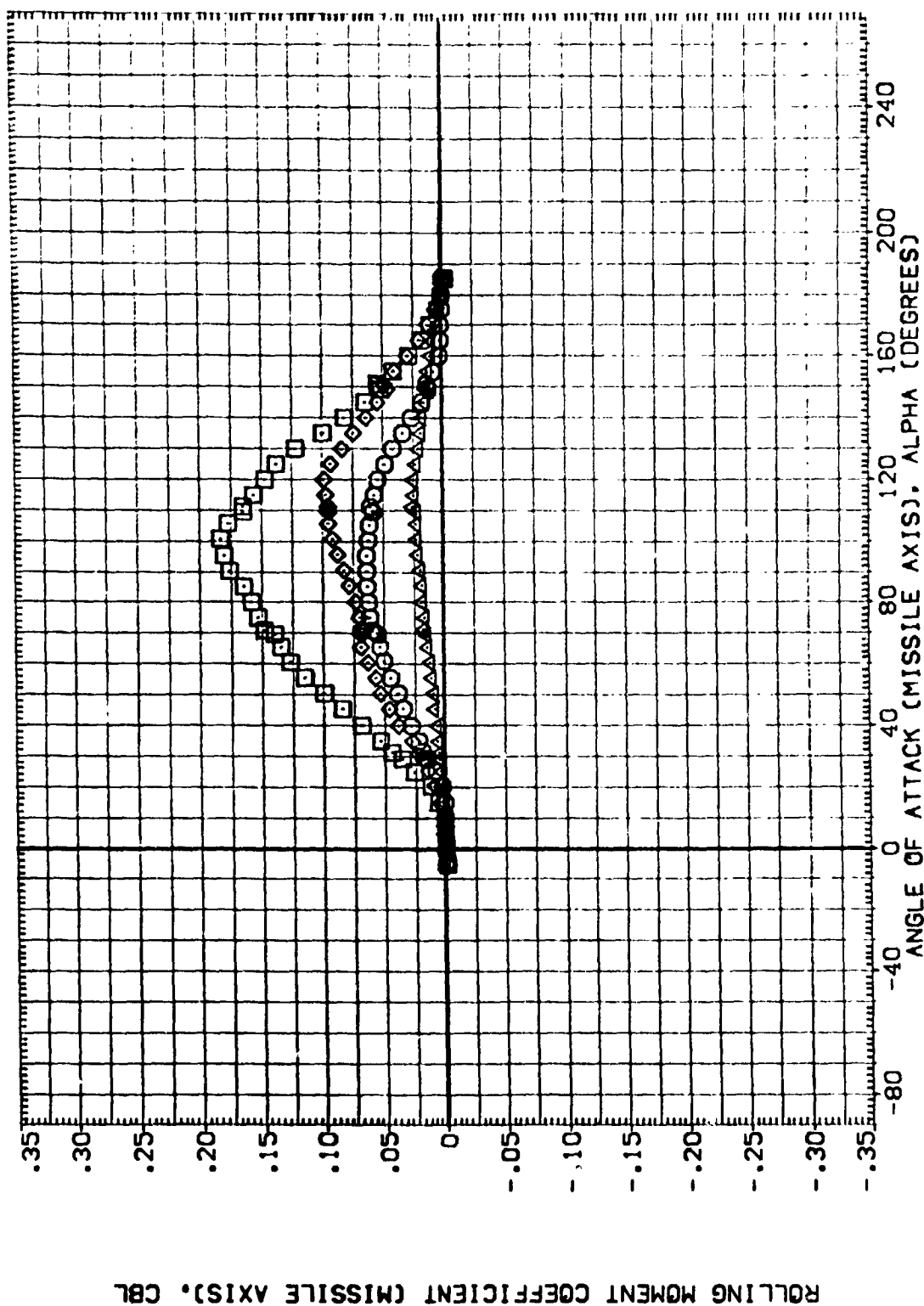


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO1)

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ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYMO1)

PMI	PARAMETRIC VALUES	REFERENCE INFORMATION
180.	10.400 RN/L	SREF 594.1360 SQ.FT.
225.	1.160	LREF 330. IN.
270.000		BREF 330. IN.
315.000		XTRP 1406. IN.XT
		YTRP . IN.YT
		ZTRP . IN.ZT
		SCALE .

□ ◇ △

CENTER OF PRESSURE LOCATION, XCP/L

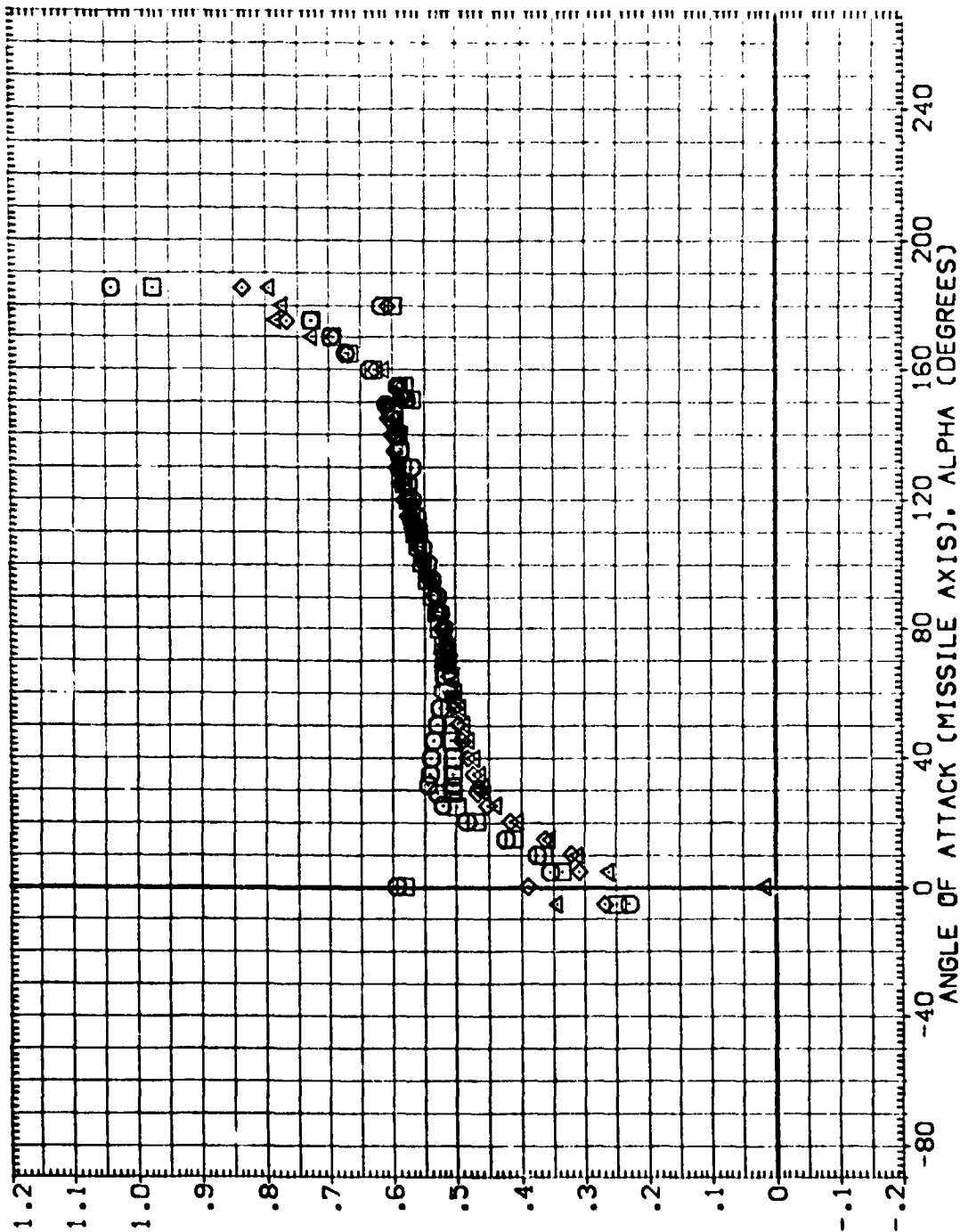


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (DEYMO1)

PHI	PARAMETRIC VALUES	REFERENCE INF	TION
45.	10.400 RV/L 1.160	SREF 594.1360	50.FT.
90.		LREF 330.	IN.
136.000		BREF 330.	IN.
		XMRP 1406.	IN.XT
		YMRP .	IN.YT
		SCALE .	IN.ZT

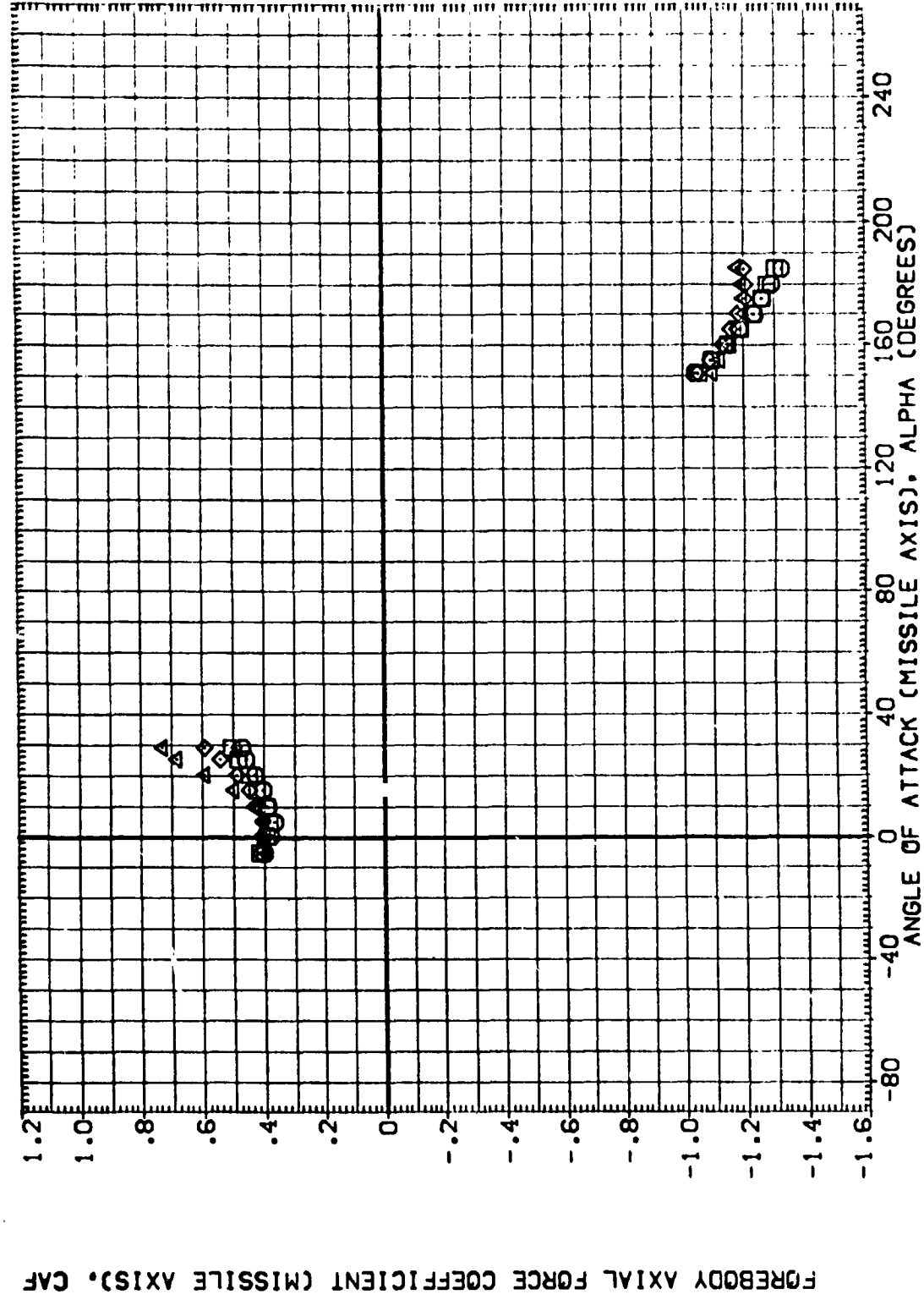


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (DEYMO1)

PHI 180.
 270.
 315.
 P 10.400 TRIC V S 1.160
 LREF 594.1
 BREF 330.
 XMRP 14
 YMRP 14
 SCALE
 TION 50.F7.
 IN.
 IN.
 IN.
 IN.
 IN.
 IN.

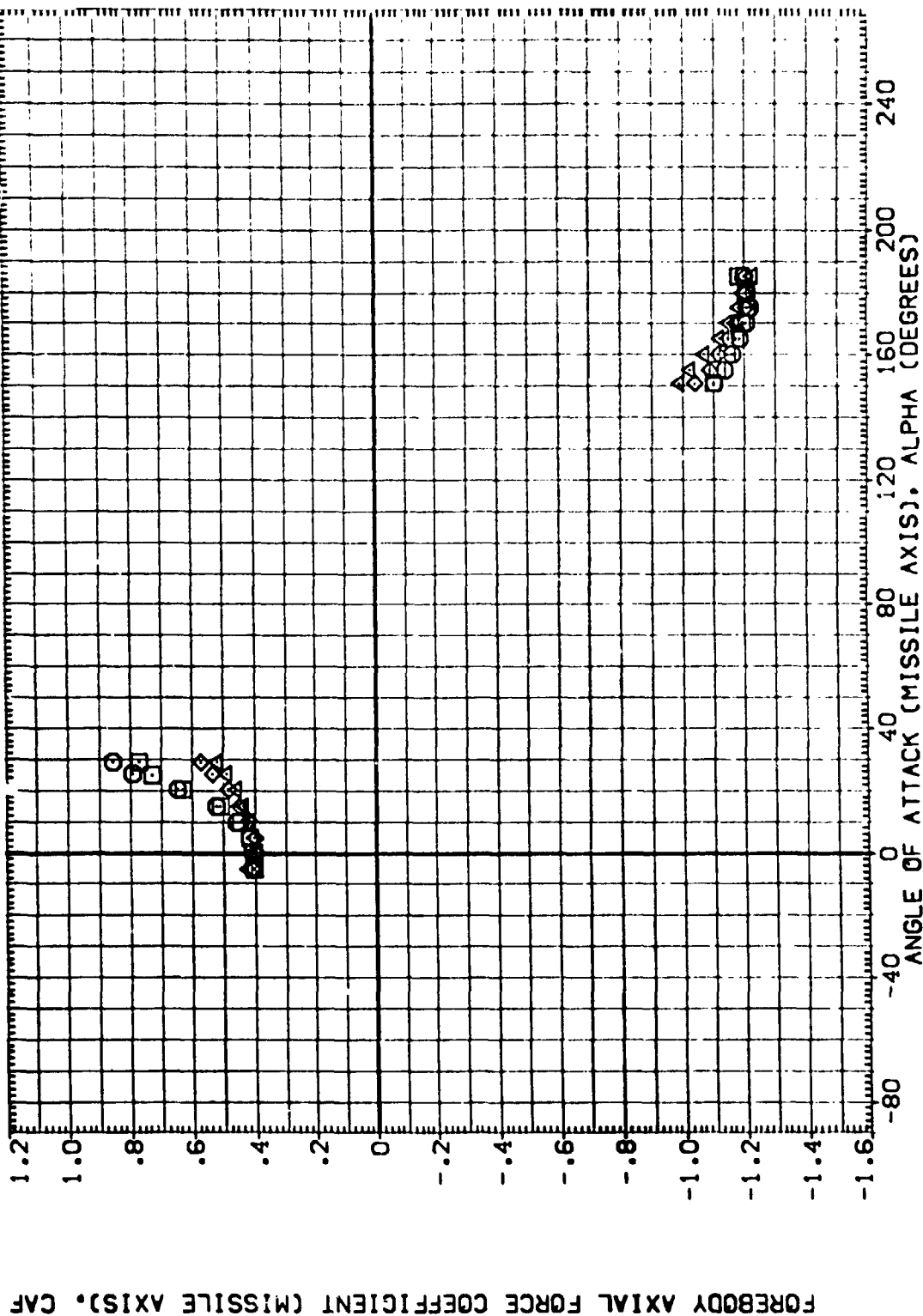


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

1. ON
2. 9. FT.
3. IN.
4. IN.
5. IN.
6. IN.
7. IN.
8. IN.
9. IN.
10. IN.
11. IN.
12. IN.
13. IN.
14. IN.
15. IN.
16. IN.
17. IN.
18. IN.
19. IN.
20. IN.
21. IN.
22. IN.
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24. IN.
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26. IN.
27. IN.
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37. IN.
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39. IN.
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78. IN.
79. IN.
80. IN.
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83. IN.
84. IN.
85. IN.
86. IN.
87. IN.
88. IN.
89. IN.
90. IN.
91. IN.
92. IN.
93. IN.
94. IN.
95. IN.
96. IN.
97. IN.
98. IN.
99. IN.
100. IN.

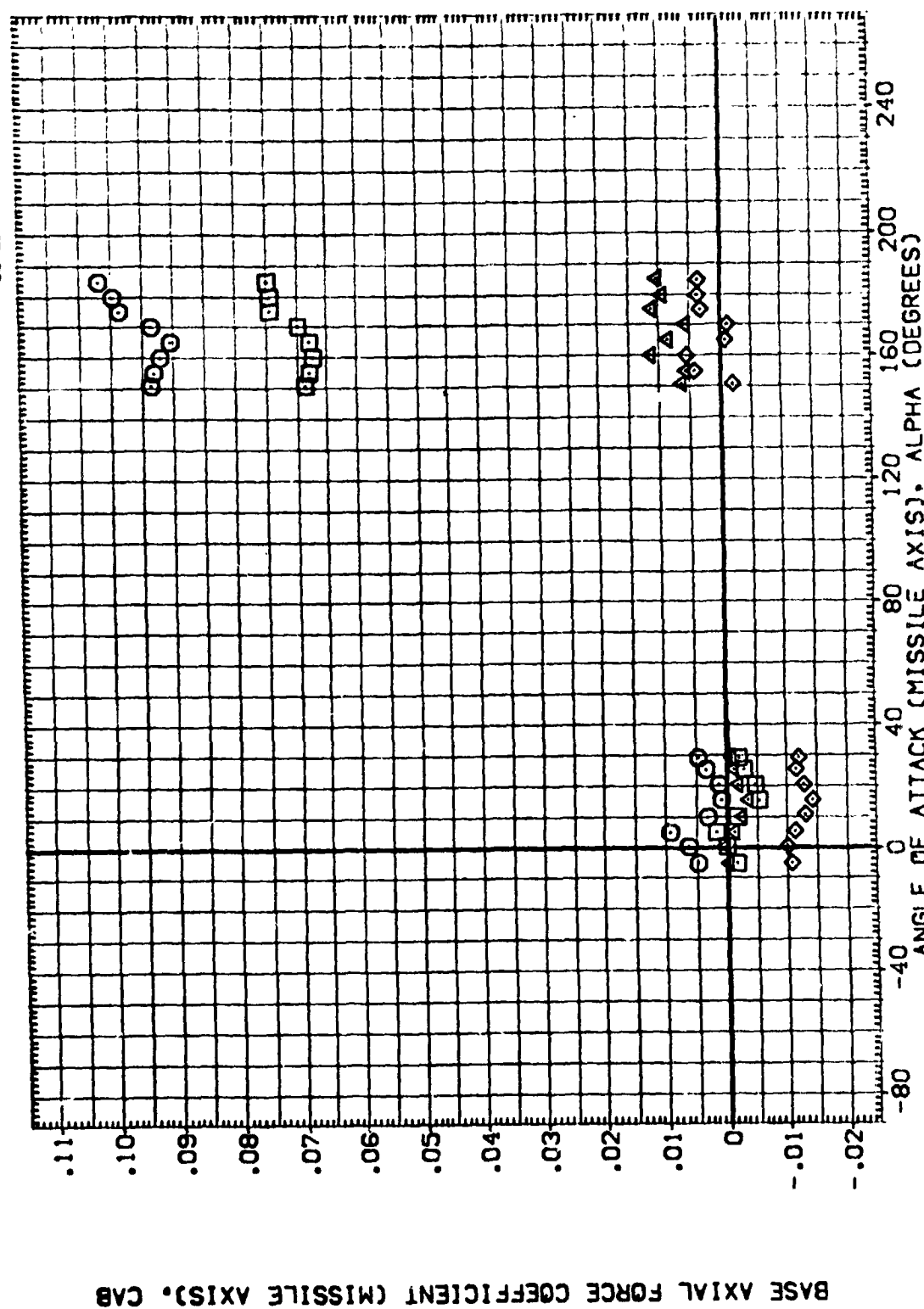


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

{DEYMOI}

REFE	INF	SD.FT.
SREF	594.1	IN.
LREF	330.	IN.
BREF	330.	IN.XT
XMRP	1406.	IN.YT
YMRP	.	IN.ZT
ZMRP	.	
SCALE	.	

P. TRIC VALUES
10.400 RN/L 1.160

PHI 100. 225. 270. 315.

◻ ◻ ◻ ◻

BASE AXIAL FORCE COEFFICIENT (MISSILE AXIS), CAB

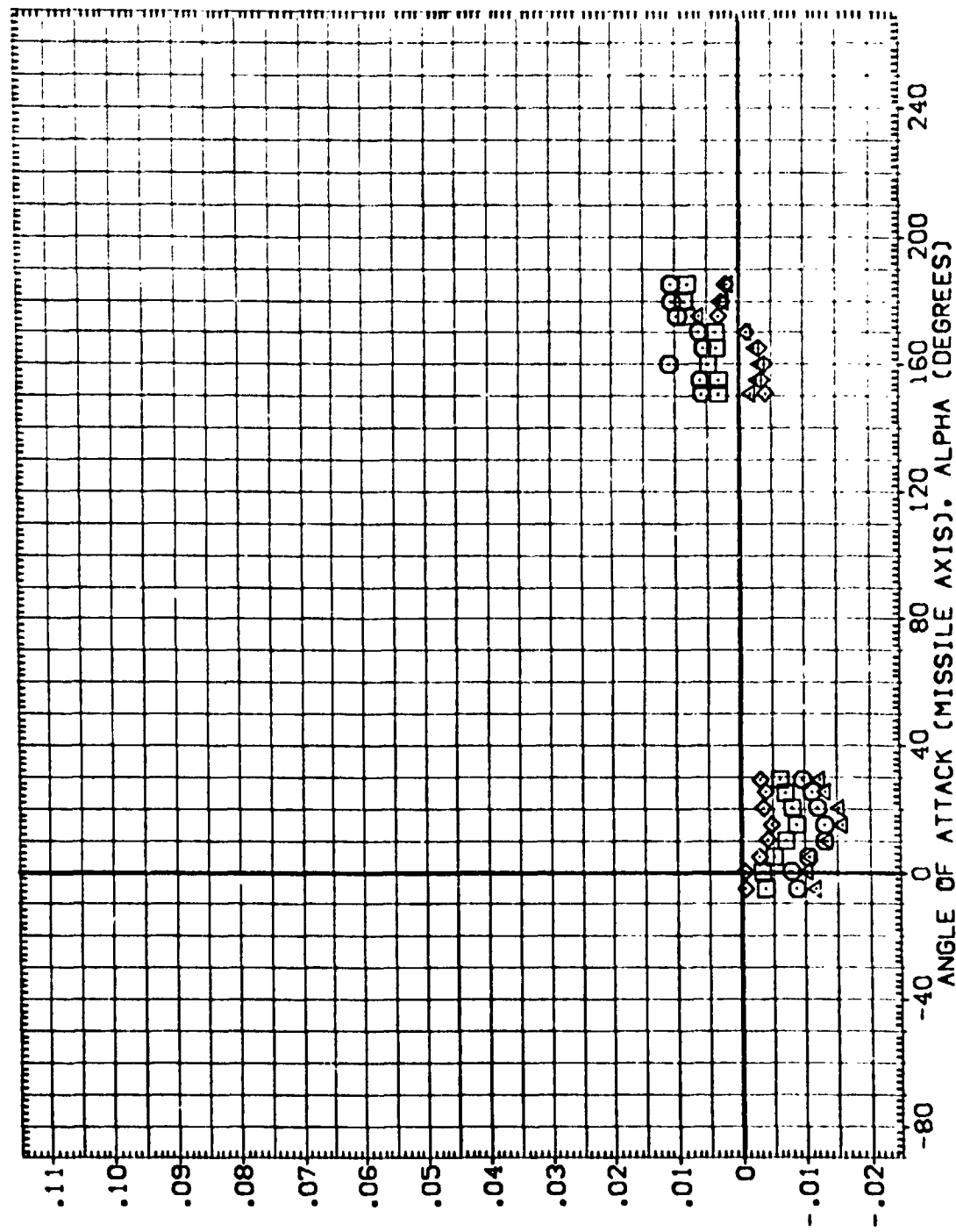


FIG. 4 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (BASIC TANK)

(CEYM02)

PHI :
O

P. TRIC VALLES
10.400 RVL 1.160

REFERENCE INFORMATION
SREF 594.1360 SQ.FT.
LREF 330. IN.
BREF 330. IN.
XMRP 1406. IN.
YMRP . IN.
ZMRP . IN.
SCALE .

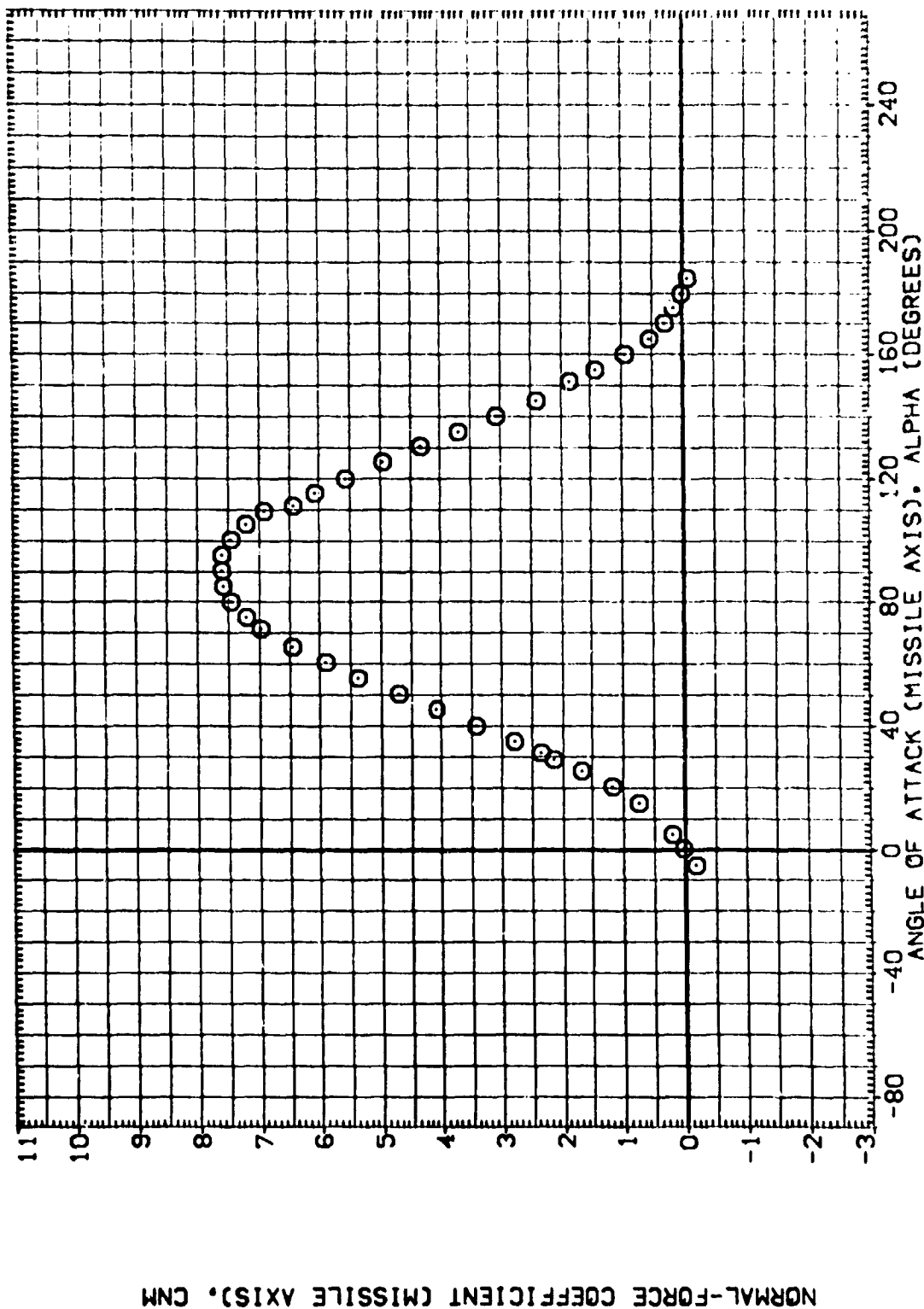


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (BASIC TANK)

(CEYM02)

PHI	MACH	PARAMETRIC VALUES	REFERENCE INF	TION
0		10.400 RN/L	594.1360	50.FT.
		1.160	330.	IN.
			330.	IN.
			1406.	IN.XT
				IN.YT
				IN.ZT
				SCALE

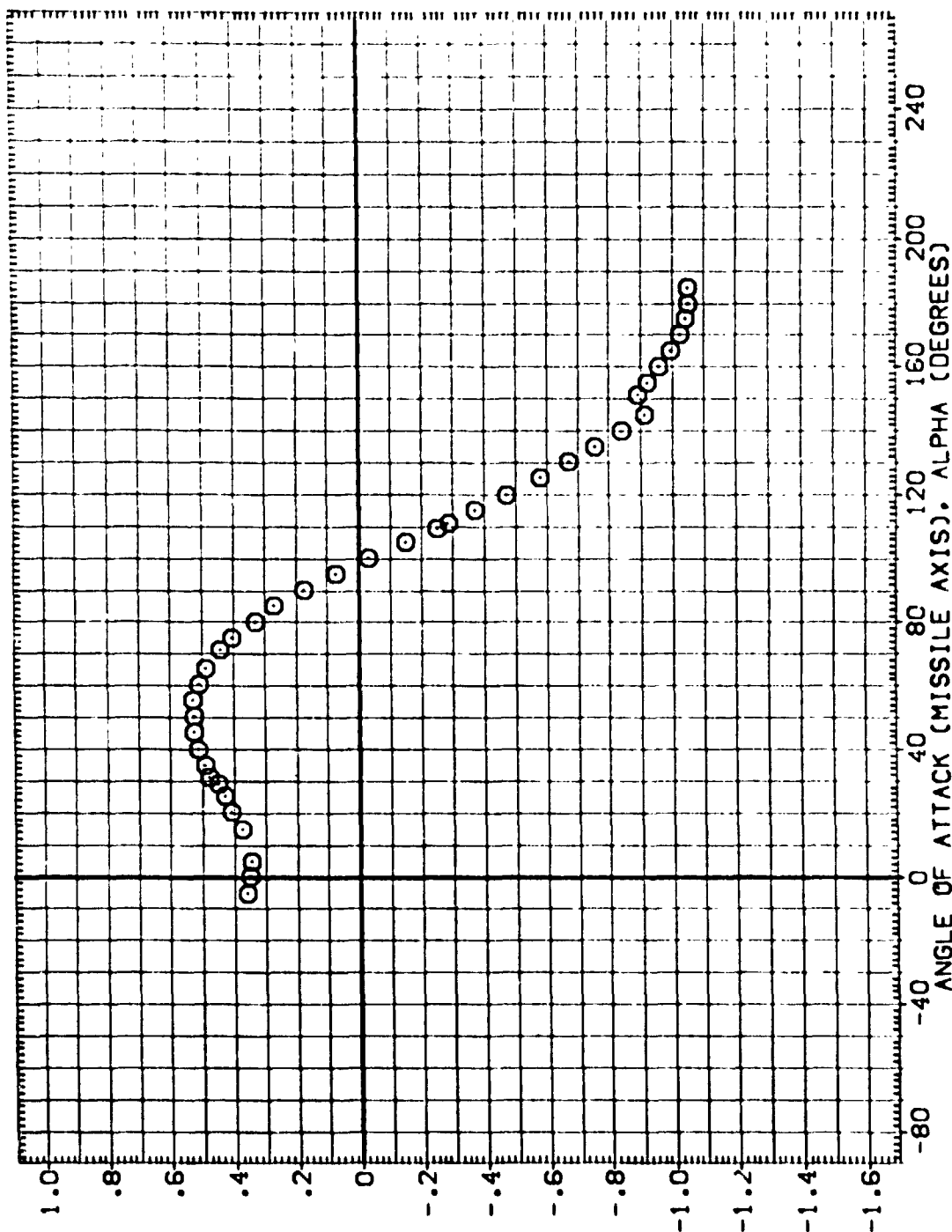


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

(CEYMO2)

A 3.5-196 T9F ET (BASIC TANK)

REFERENCE INFORMATION
 F 594.1360 SQ.FT.
 LREF 330. IN.
 BREF 330. IN.
 1406. IN.XT
 YMRP . IN.YT
 ZMRP . IN.ZT
 SCALE .

P 10.400 M/L 1.160

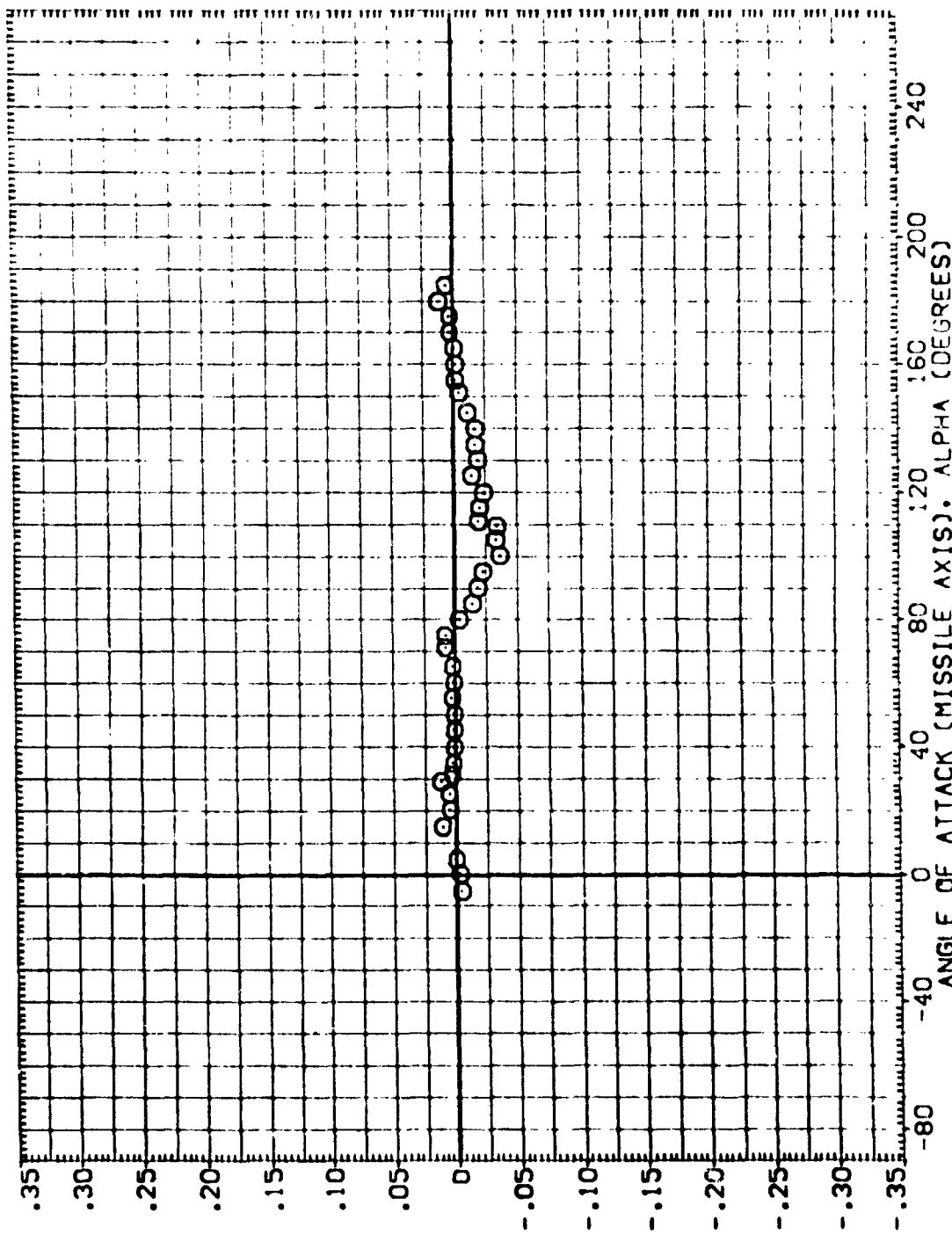


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

A 3.5-196 TA9F ET (BASIC TANK)

(CEYMO2)

O
 PHI
 10.
 TRIC VAL
 1.180
 SREF
 LREF
 BREF
 XREF
 YREF
 ZREF
 SCALE
 RENCE INF
 594.1
 330.
 330.
 1406.
 :
 :
 :
 TION
 90.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT

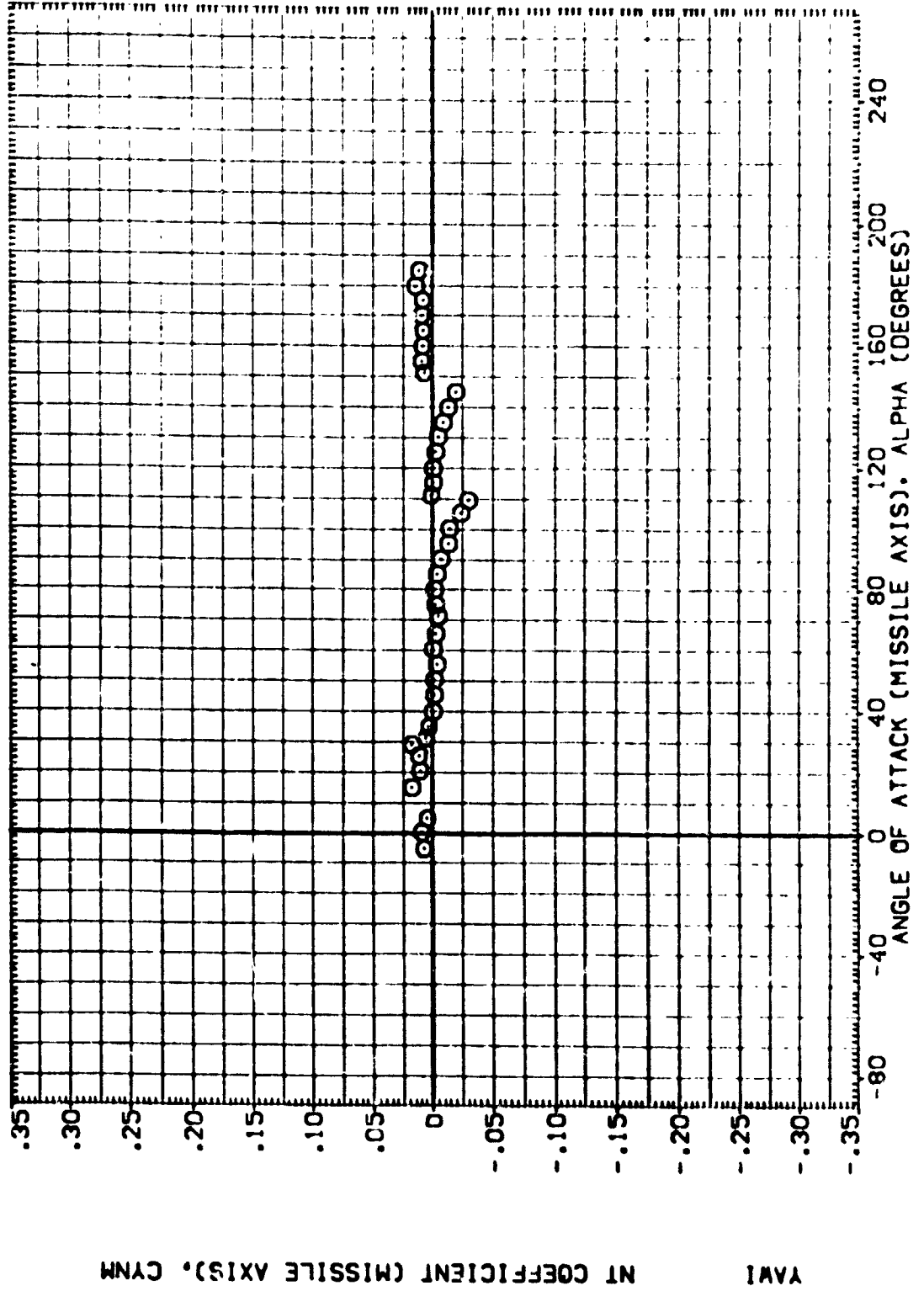


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

(CEYMOZ)

Value

9

Topic

Value

1.18

SCALE
2440Z
0400Z
Y4000
X4000
B4000
L4000
S4000

NCE INF	TION
594.1360	50.FT.
330.	IN.
330.	IN.
1405.	IN.XY
.	IN.VT
.	IN.ZT

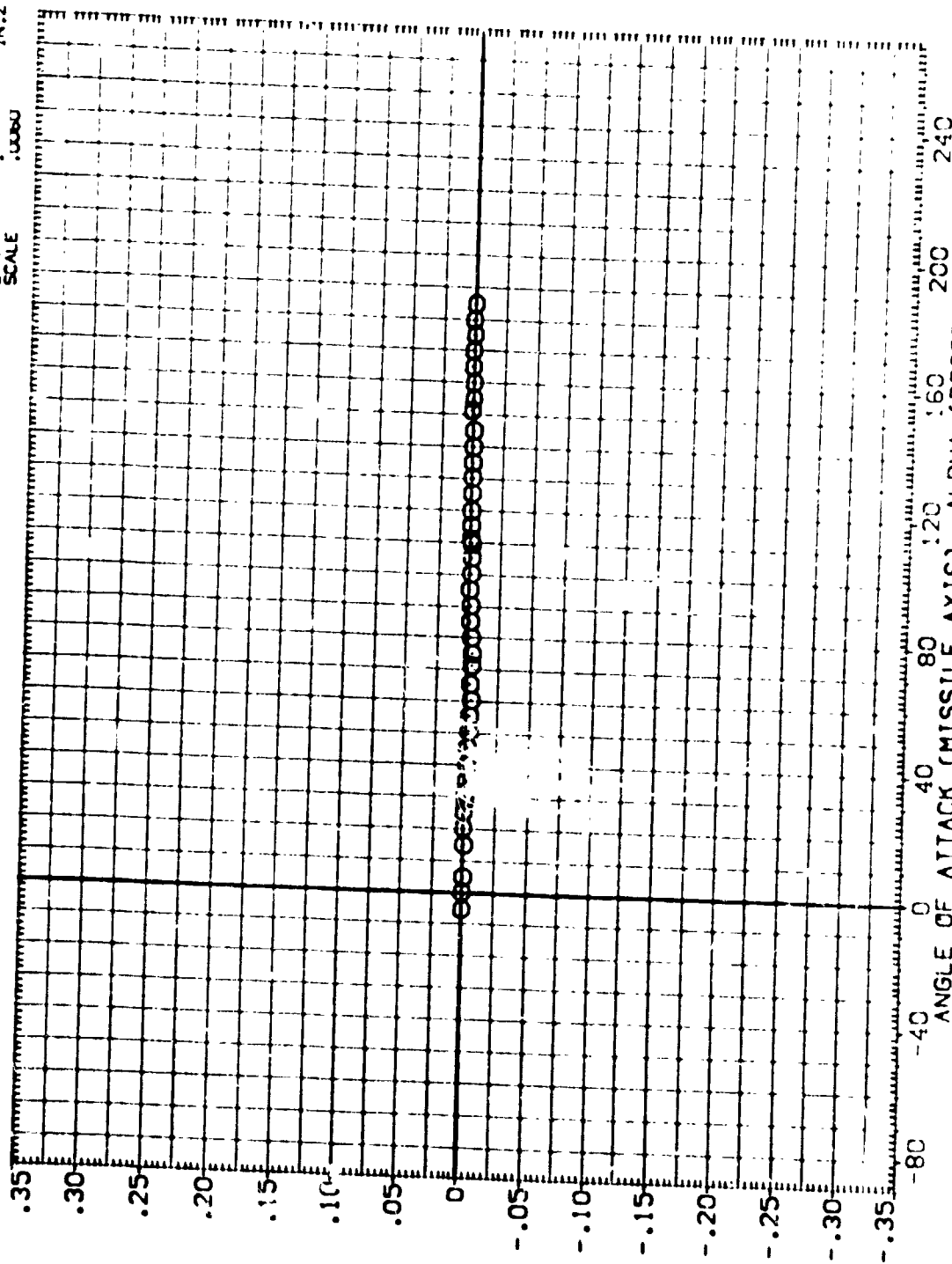


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 T-9F ET (BASIC TANK)

(CEYMD2)

PHI .000 MACH 10.400 R/L 1.160

REFERENCE INF TION
 SREF 594.1 SQ.FT.
 LREF 330. IN.
 BREF 330. IN.
 XMRP 1406. IN.XT
 YMRP . IN.YT
 ZMRP . IN.ZT
 SCALE .

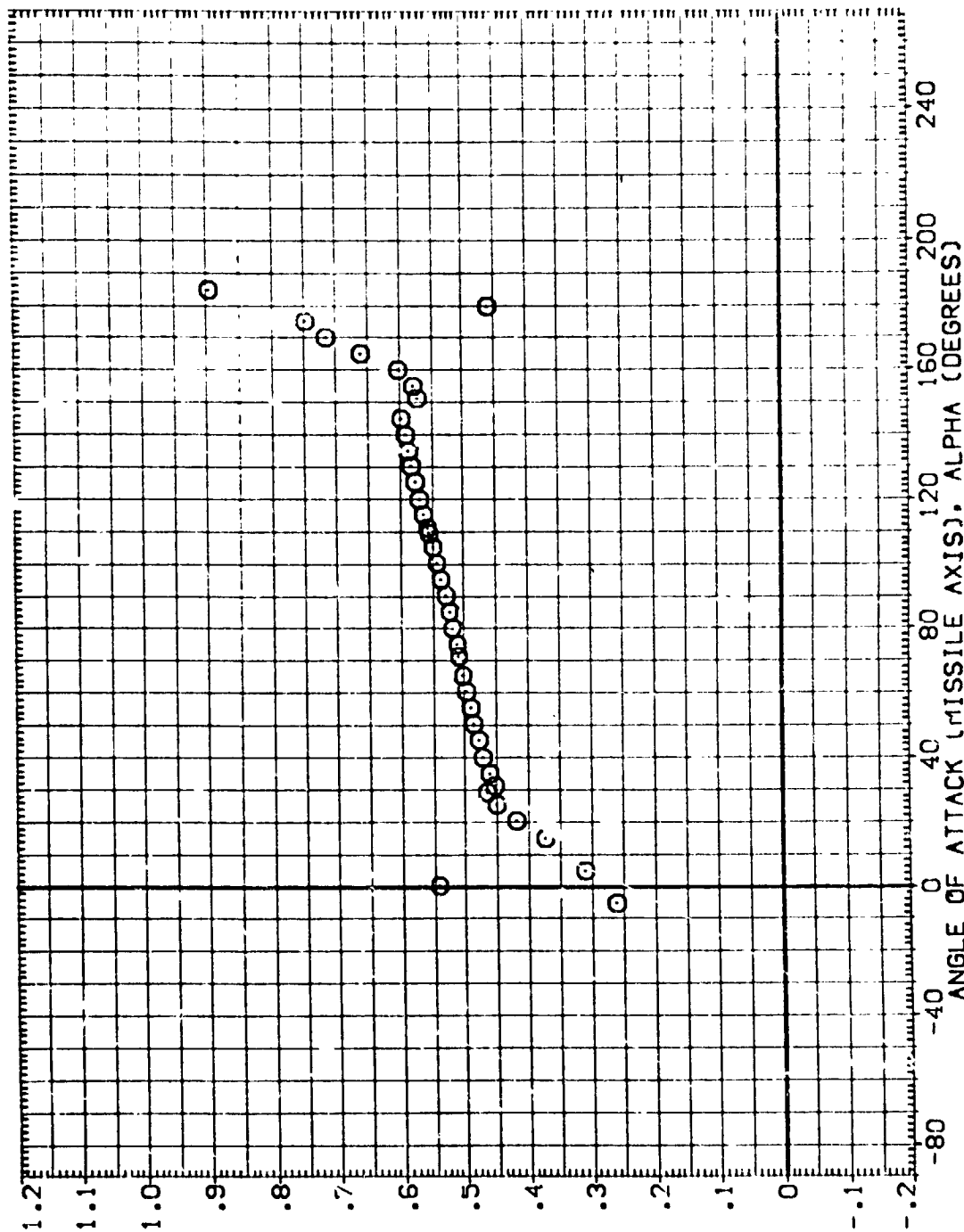


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 T9F ET (BASIC TANK)

(DEYMO2)

PHI .000 MACH 10.400 RV/L 1.160

REFERENCE INFORMATION
 SREF 594.1360 SQ.FT.
 LREF 330.2000 IN.
 BREF 330.2000 IN.
 XMRP 1406.0000 IN.
 YMRP .0000 IN.
 ZMRP .0000 IN.
 SCALE .0060

FOREBODY AXIAL FORCE COEFFICIENT (MISSILE AXIS), CAF

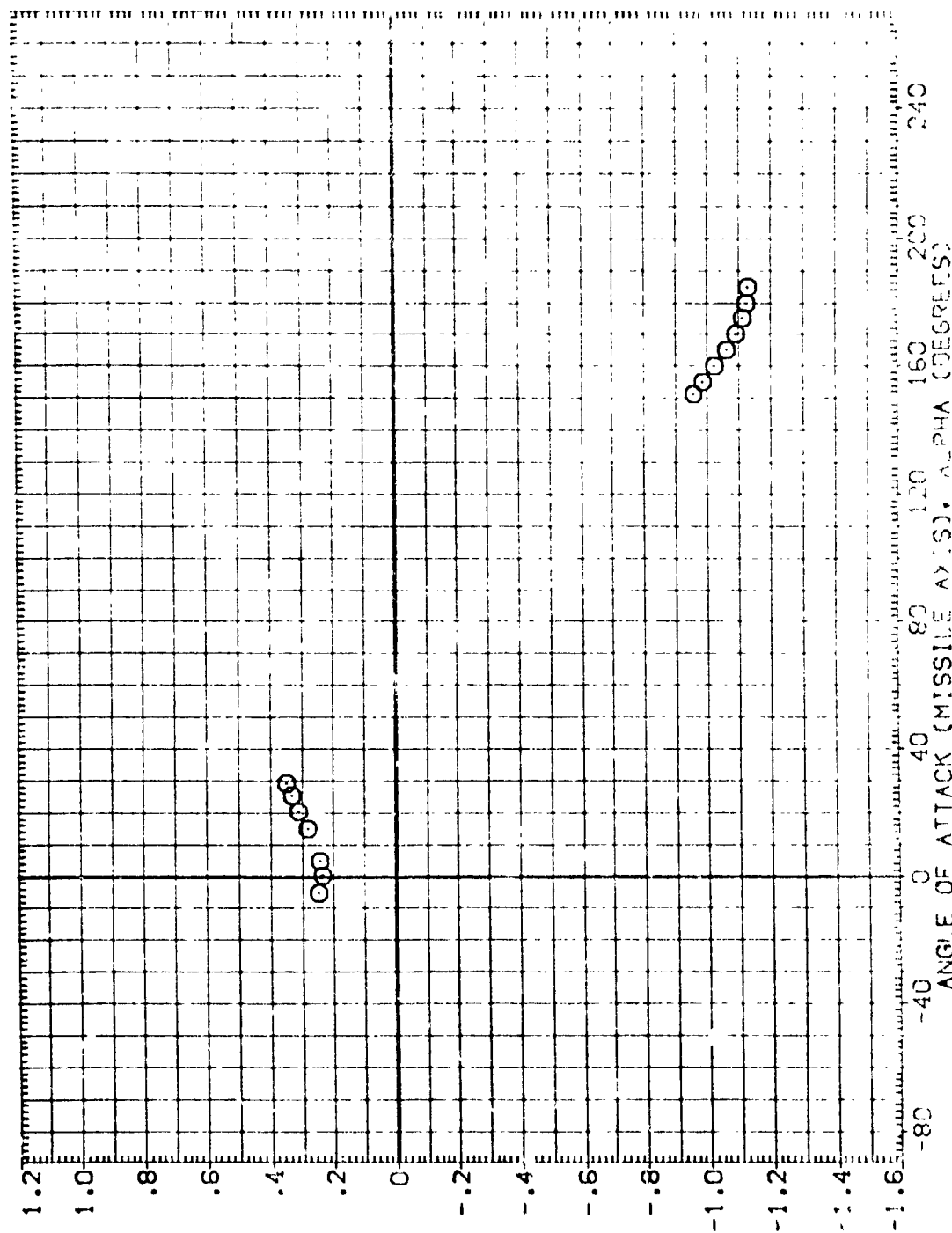


FIG. 3 COEFFICIENTS VERSUS ANGLE OF ATTACK

(DEYMO2)

ARC 3.5-196 TA9F ET (BASIC TANK)

PHI . MACH 10.400 RV/L 1.160

REFERENCE INF TION
SREF 594.1360 SQ.FT.
LREF 330. IN.
BREF 330. IN.
XMRP 1406. IN.
YMRP . IN.
ZMRP . IN.
SCALE . IN.

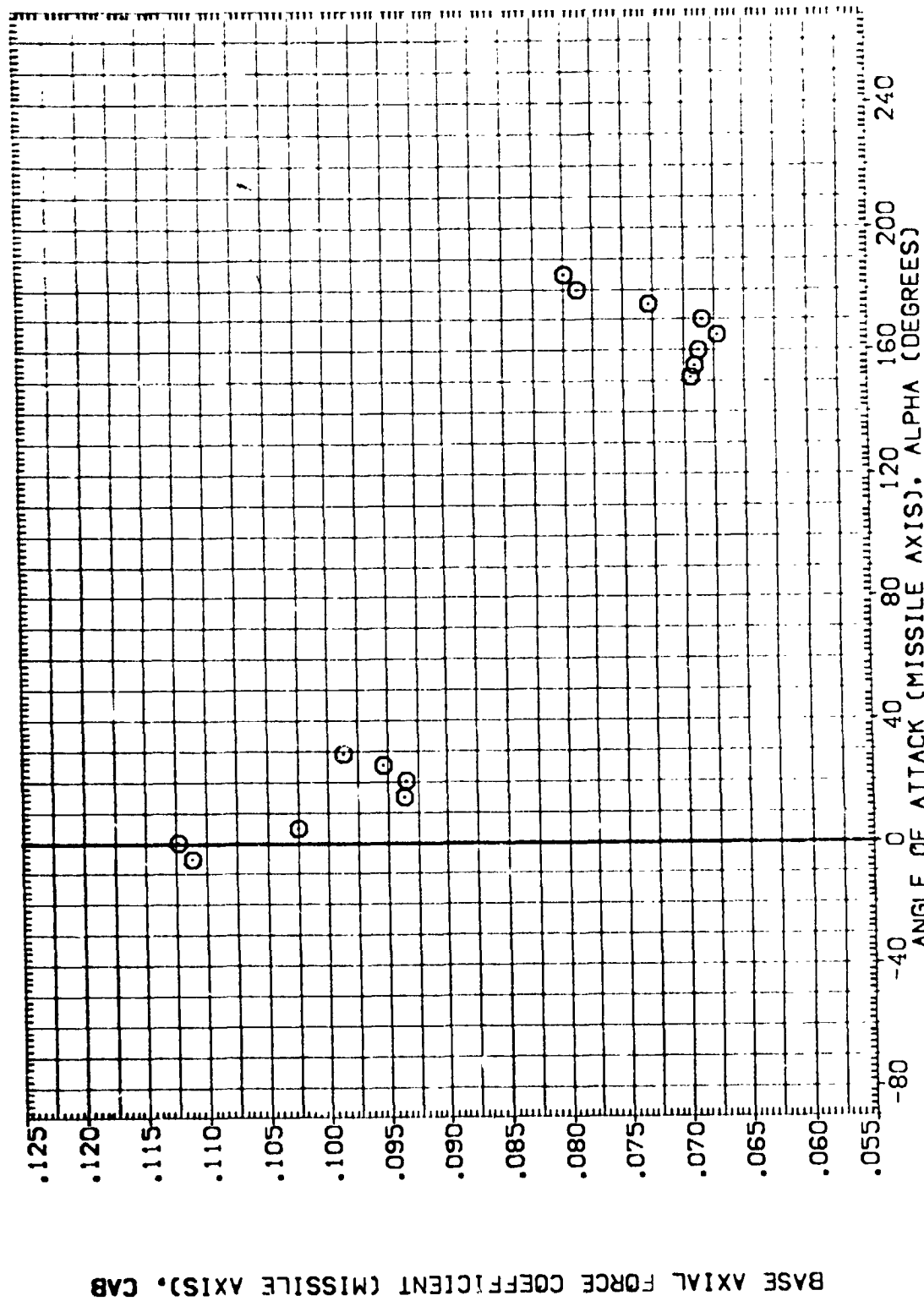


FIG. 5 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYM03)

PHI 180.000 MACH 5.300 RN/L 3.810

REFERENCE INFORMATION
 SREF 594.1360 50.FT.
 LREF 330. IN.
 BREF 330. IN.
 XMRP 1406. IN.
 YMRP . IN.
 ZMRP . IN.
 SCALE .

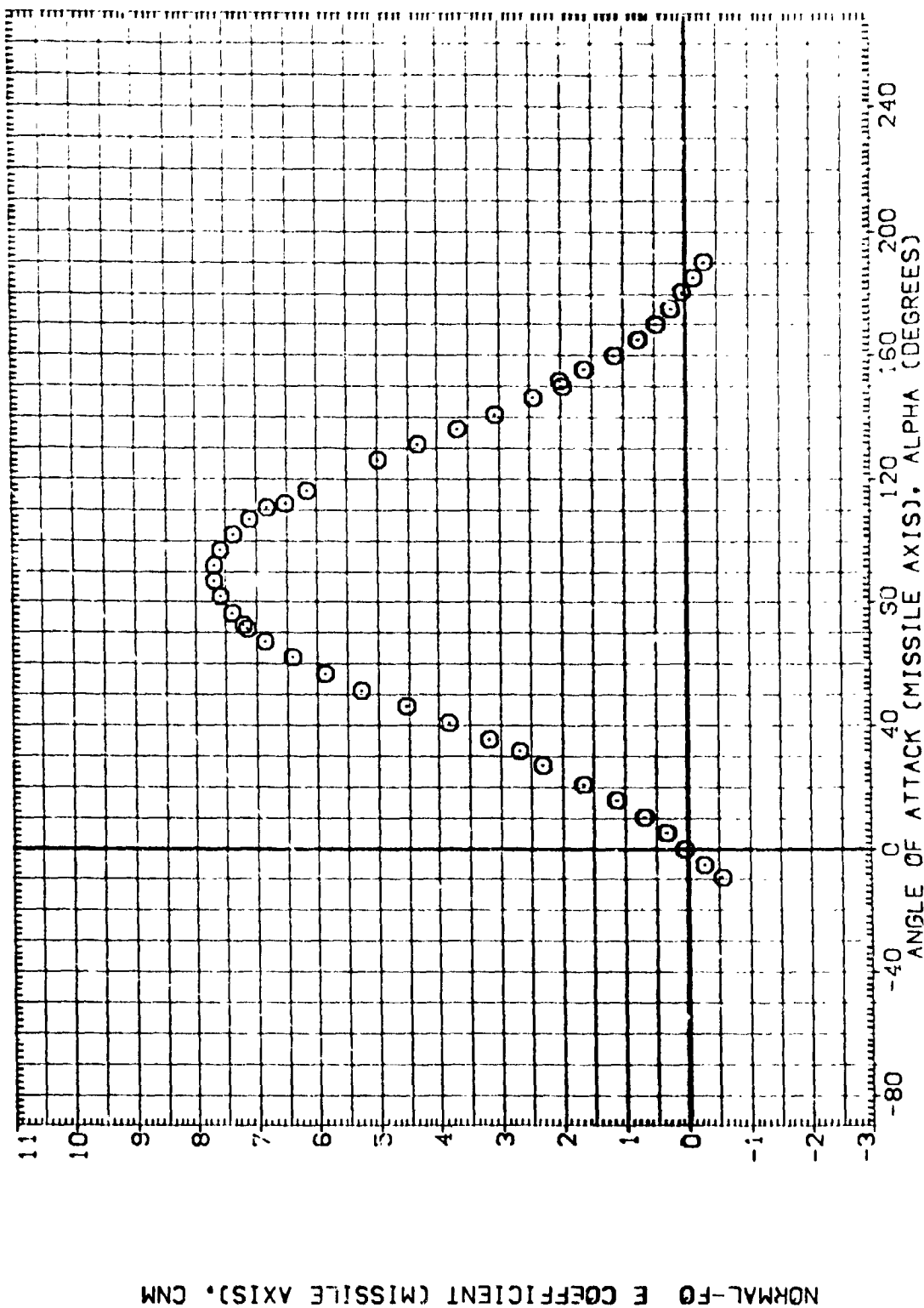


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO3)

PHI
100.

P 5.300 RV/L

3.810

REFERENCE 1
SREF 594.1360
LREF 330.
BREF 330.
XMRP 1406.
YMRP .
ZMRP .
SCALE .

TION
50.FT.
IN.
IN.
IN.XT
IN.YT
IN.ZT

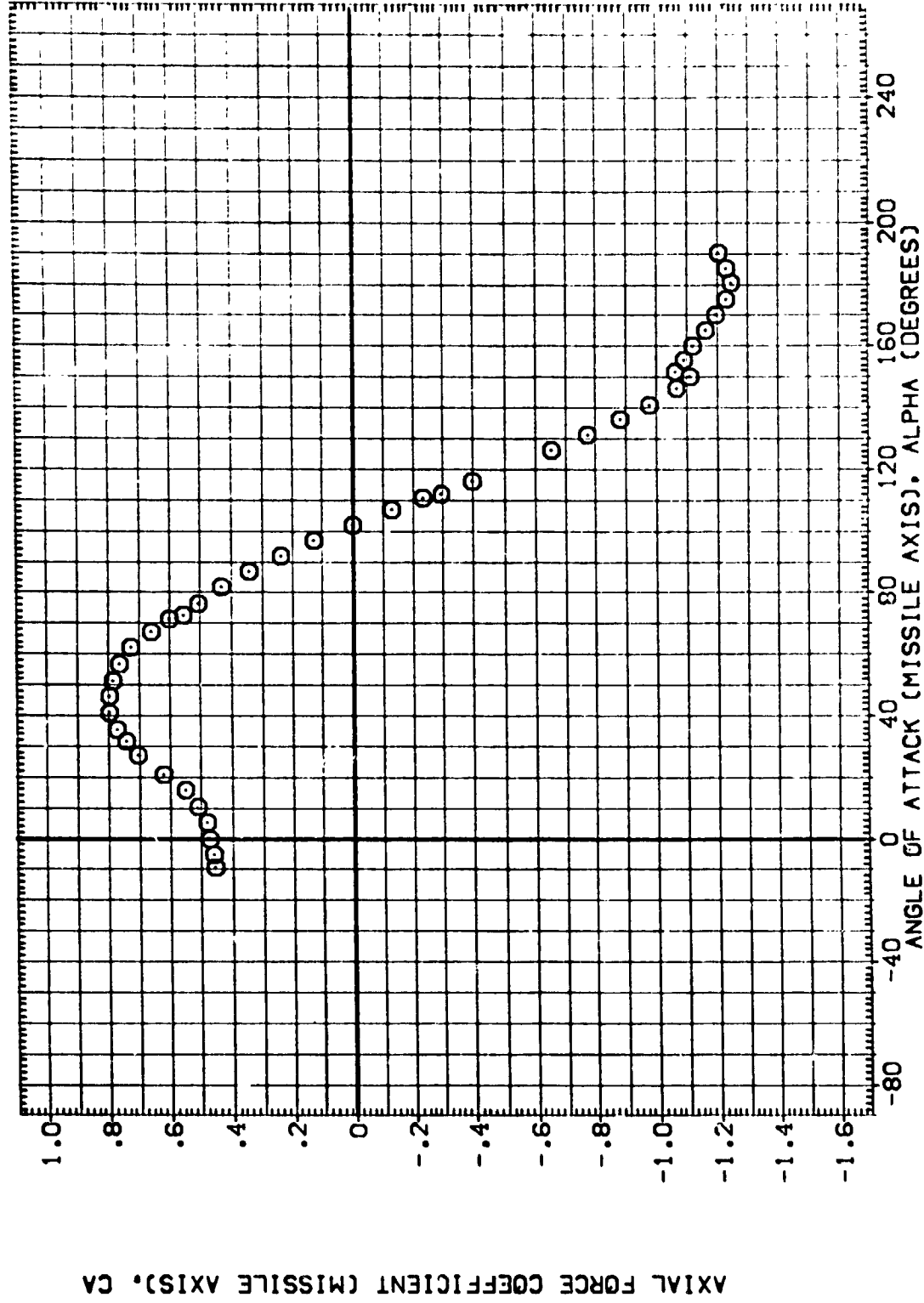


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO3)

PH1 180.
 METRIC V 5.300 RV/L 3.810
 RET 594.1
 SREF 330.
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP .
 ZMRP .
 SC/LE .0060
 TION 50.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT

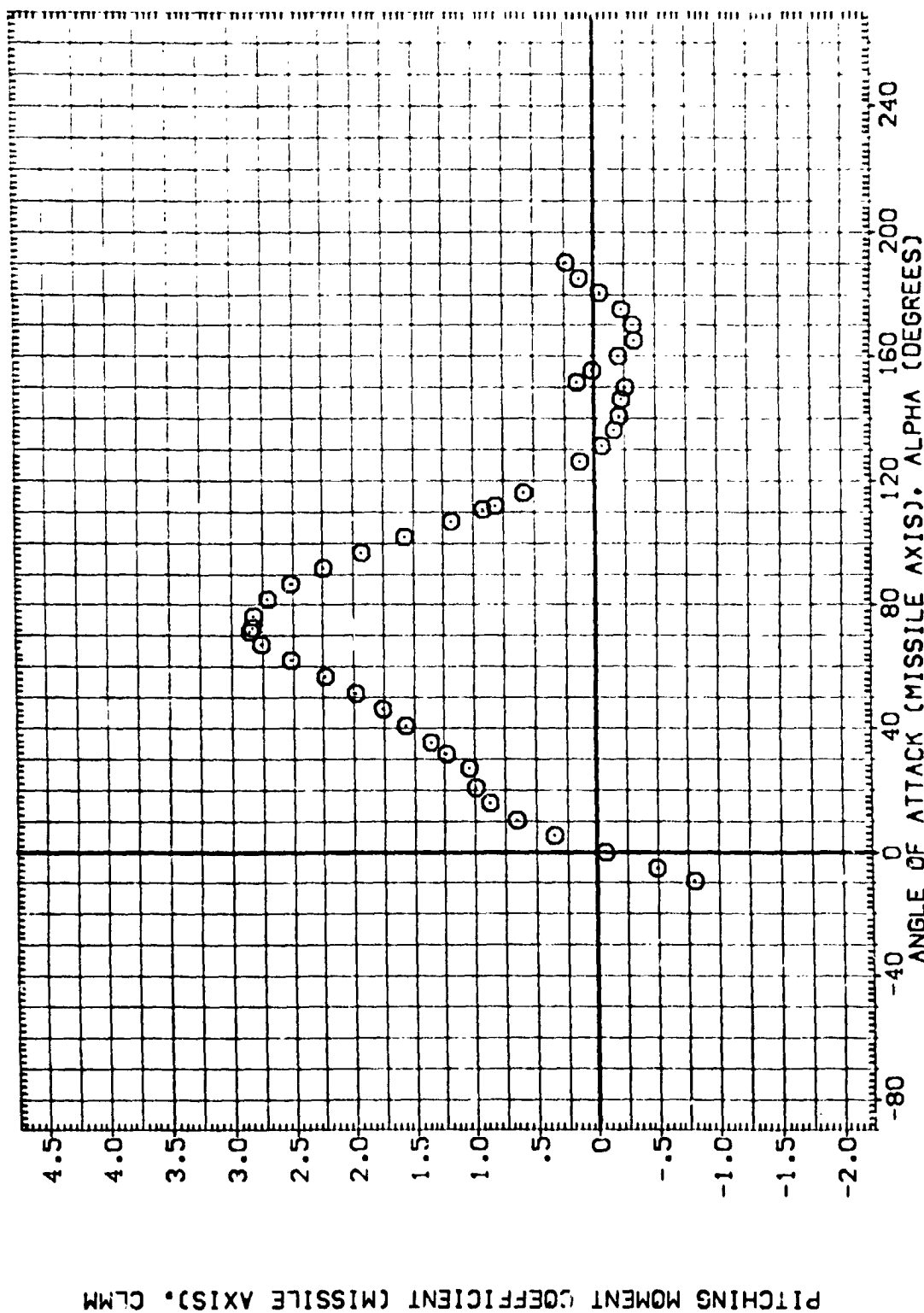


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYM03)

PHI 180.
 P 5.300 RV/L 3.810
 TRIC VALUES
 REF 594.1360 IN.
 LREF 330. IN.
 BREF 330. IN.
 XMRP 1406. IN.
 YMRP . IN.
 ZT IN.
 TION SQ.FT.
 SCALE .0000

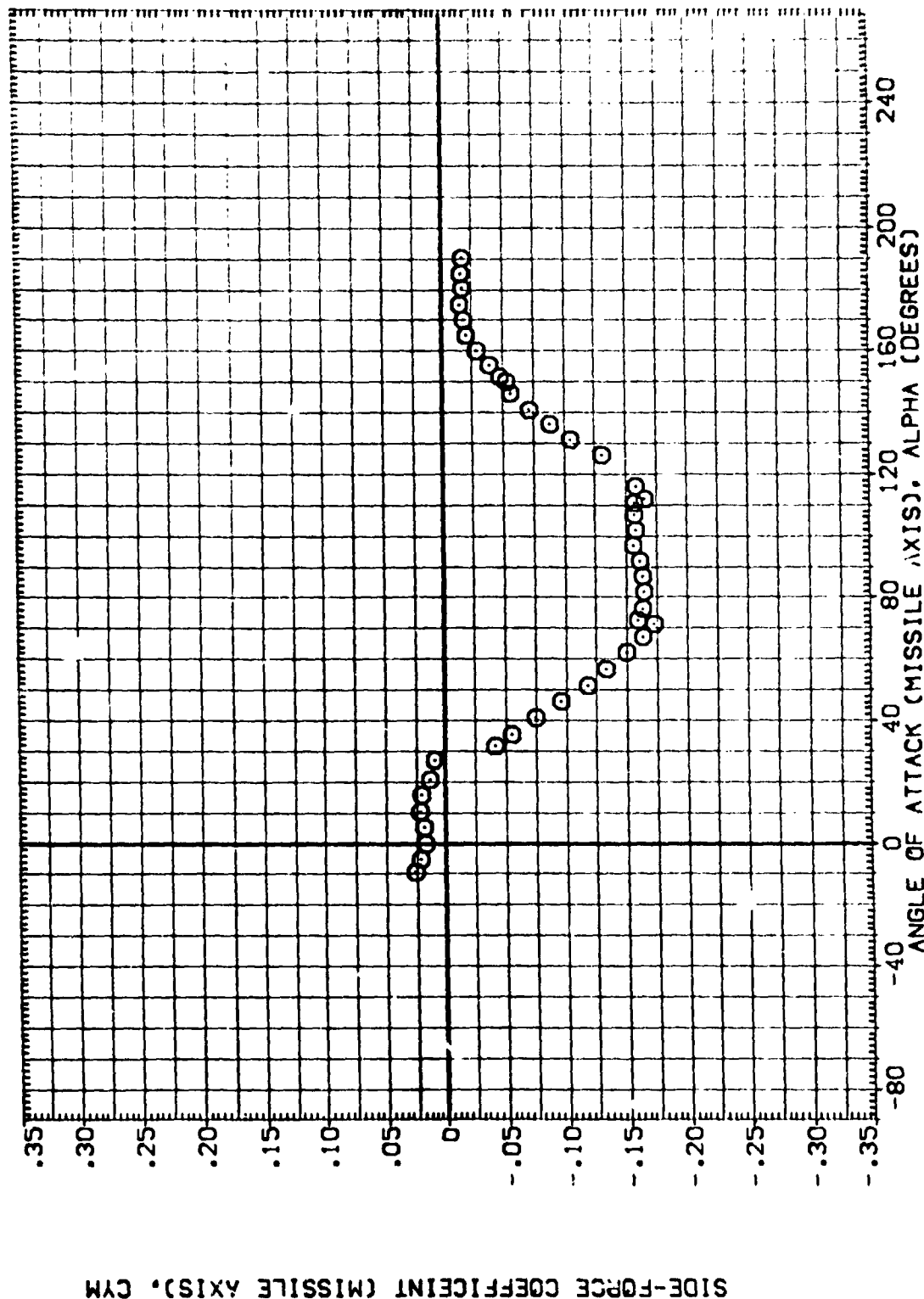


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (CEYM03)

PHI 180.
 5. TRIC V S 3.010
 REFERENCE INF 594.1
 SREF 50.4T.
 LREF IN.
 BREF IN.
 XMRP IN.
 YMRP IN.
 N.YT
 N.YT
 N.ZT
 SCALE .

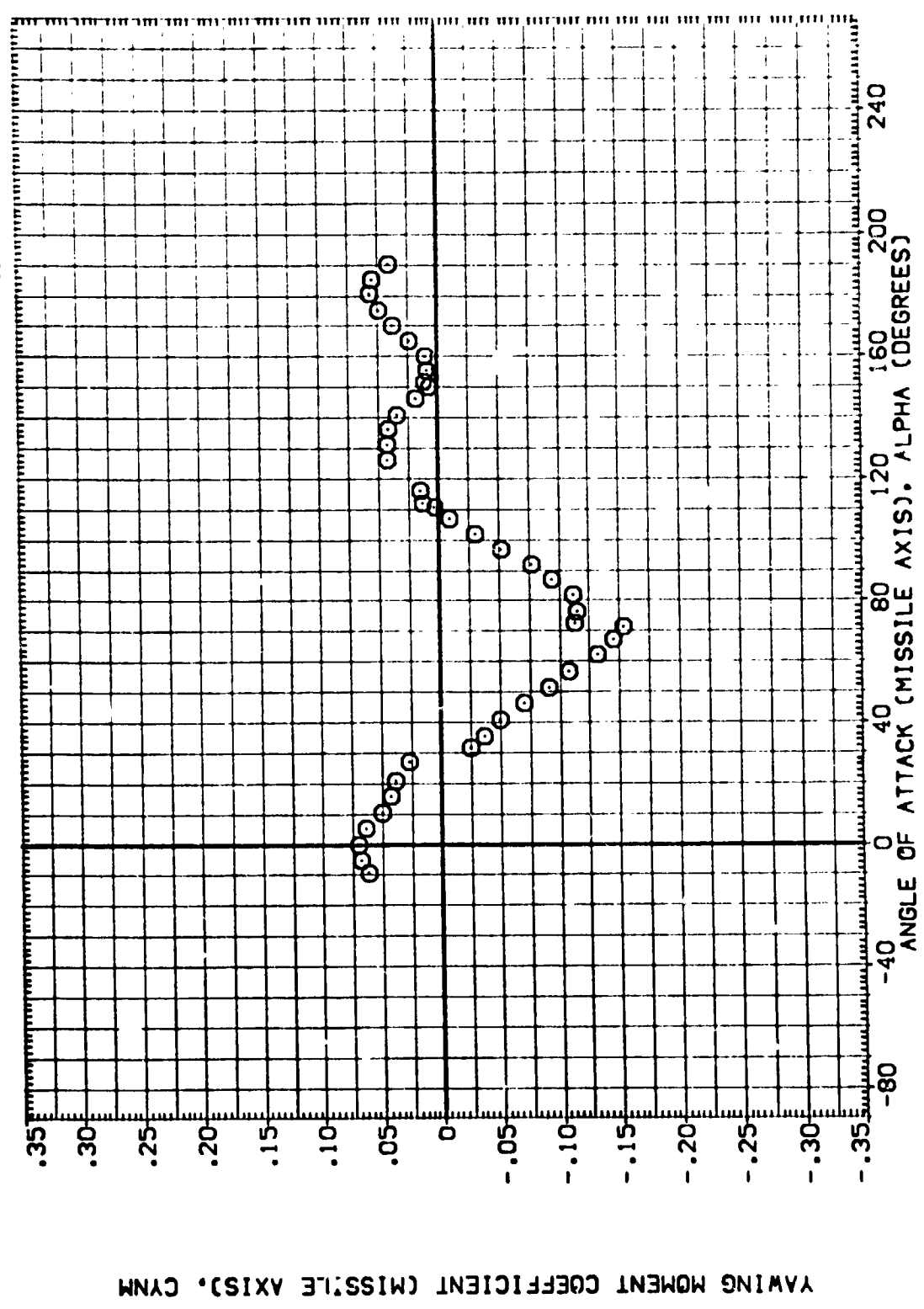


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYM03)

PHI 180.
 5.
 3.810
 RV/L
 REFERENCE INF
 SREF 594.1360
 LREF 330.
 BREF 330.
 YMRP 1406.
 ZMRP .
 SCALE .

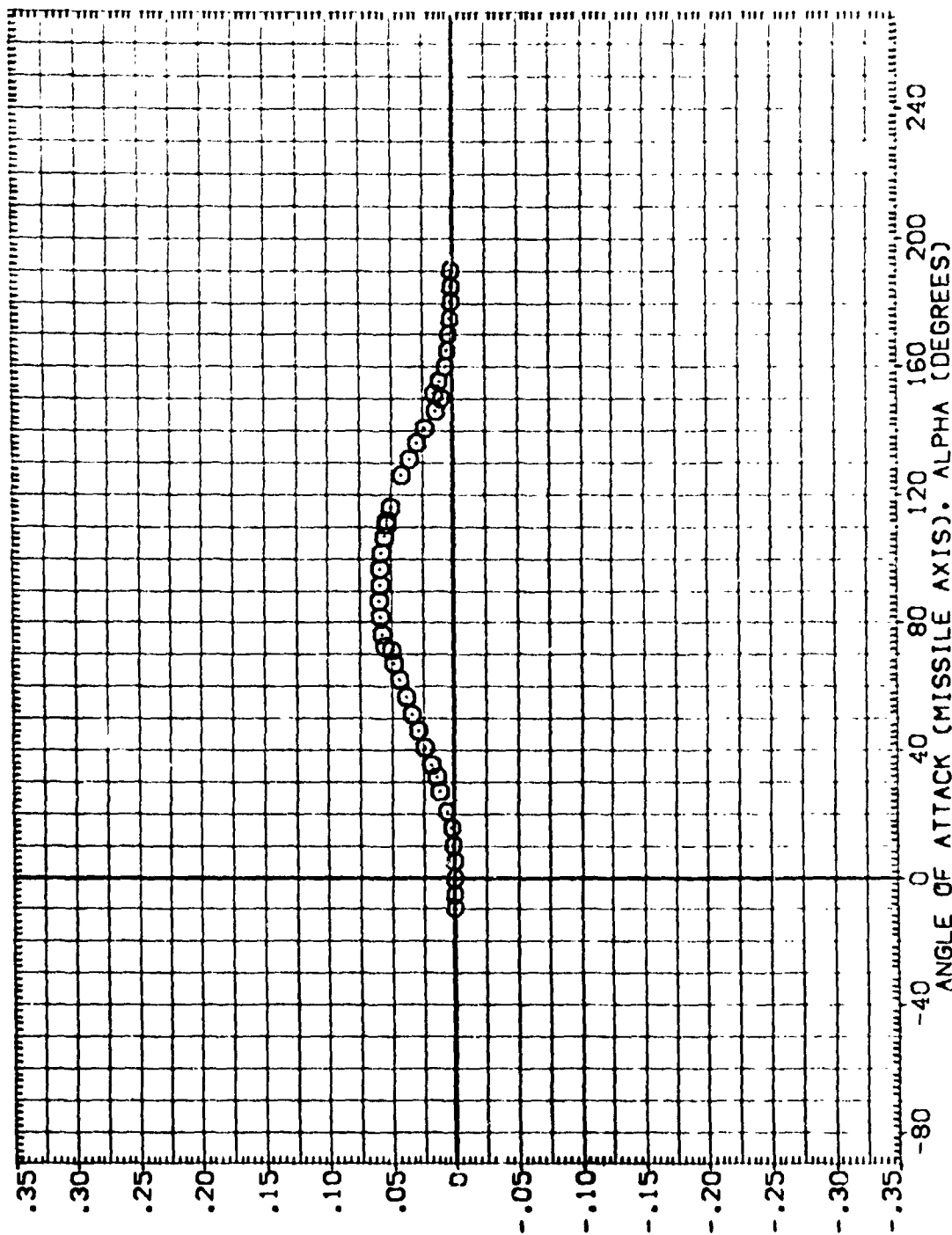


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYMO3)

O PHI :80. MACH 5.300 RN/L 3.810
 PARAMETRIC VALUES
 REF 594.1 IN. TION
 LREF 330. IN.
 BREF 330. IN. XI
 XMRP 1406. IN. XI
 YMRP : IN. YI
 ZMRP : IN. ZI
 SCALE :

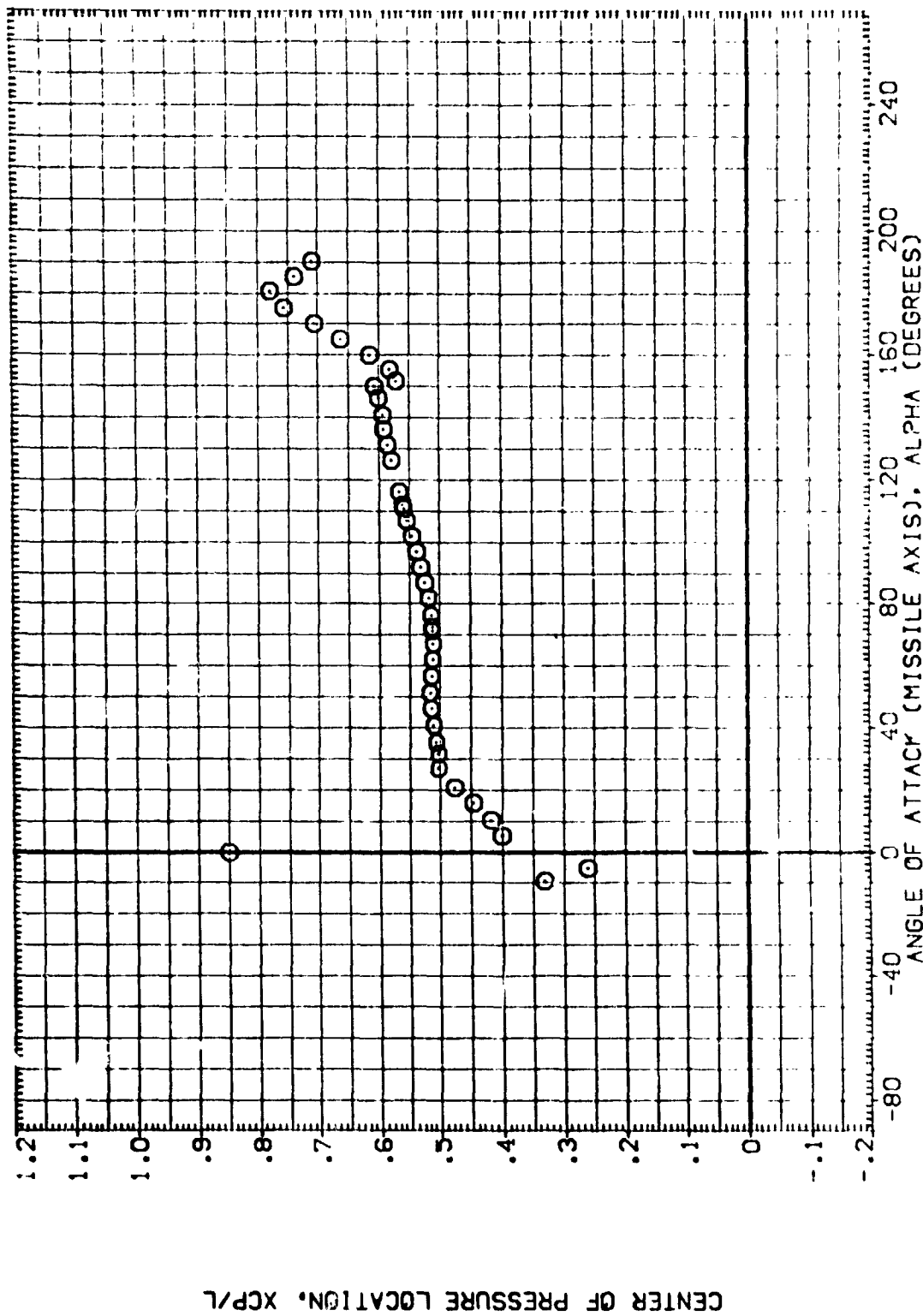


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES) (DEYMO3)

PHI 100.
 PARAMETRIC VALUES 3.010
 5.300 MW/L
 REFERENCE INF 594.1
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP :
 ZMRP :
 SCALE :
 TION 50.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT

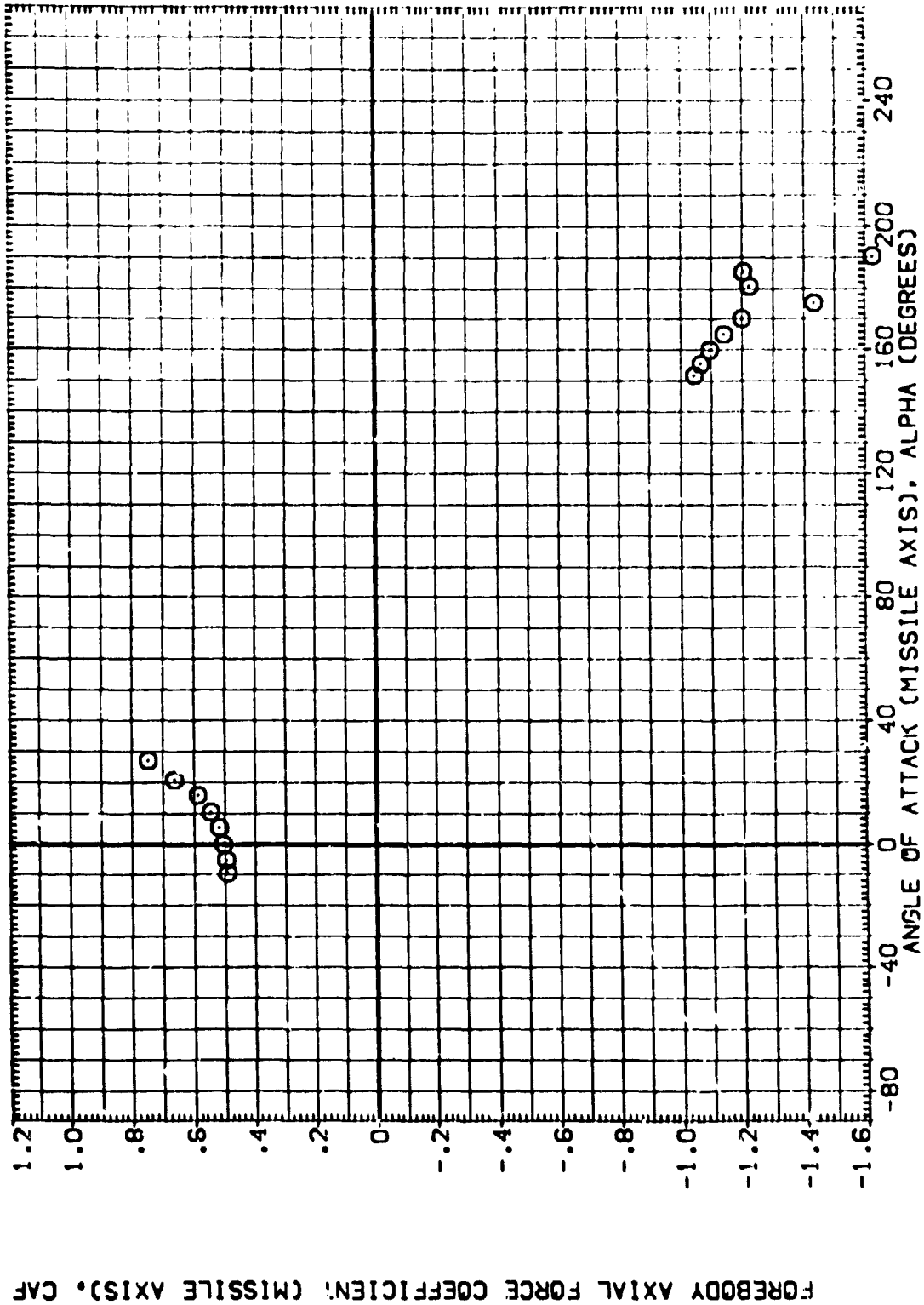


FIG. 6 COEFFICIENTS VERSUS ANGLE OF ATTACK

(DEYMO3)

ॐ

i

TRIC V S

3.810

F	59A.1
LREF	330.
BREF	330.
XMRP	:40E.
YMRP	.
ZMRP	.
SCALE	.

Y10N
SQ. FT.
IN.
IN.
IN.
IN.
IN.

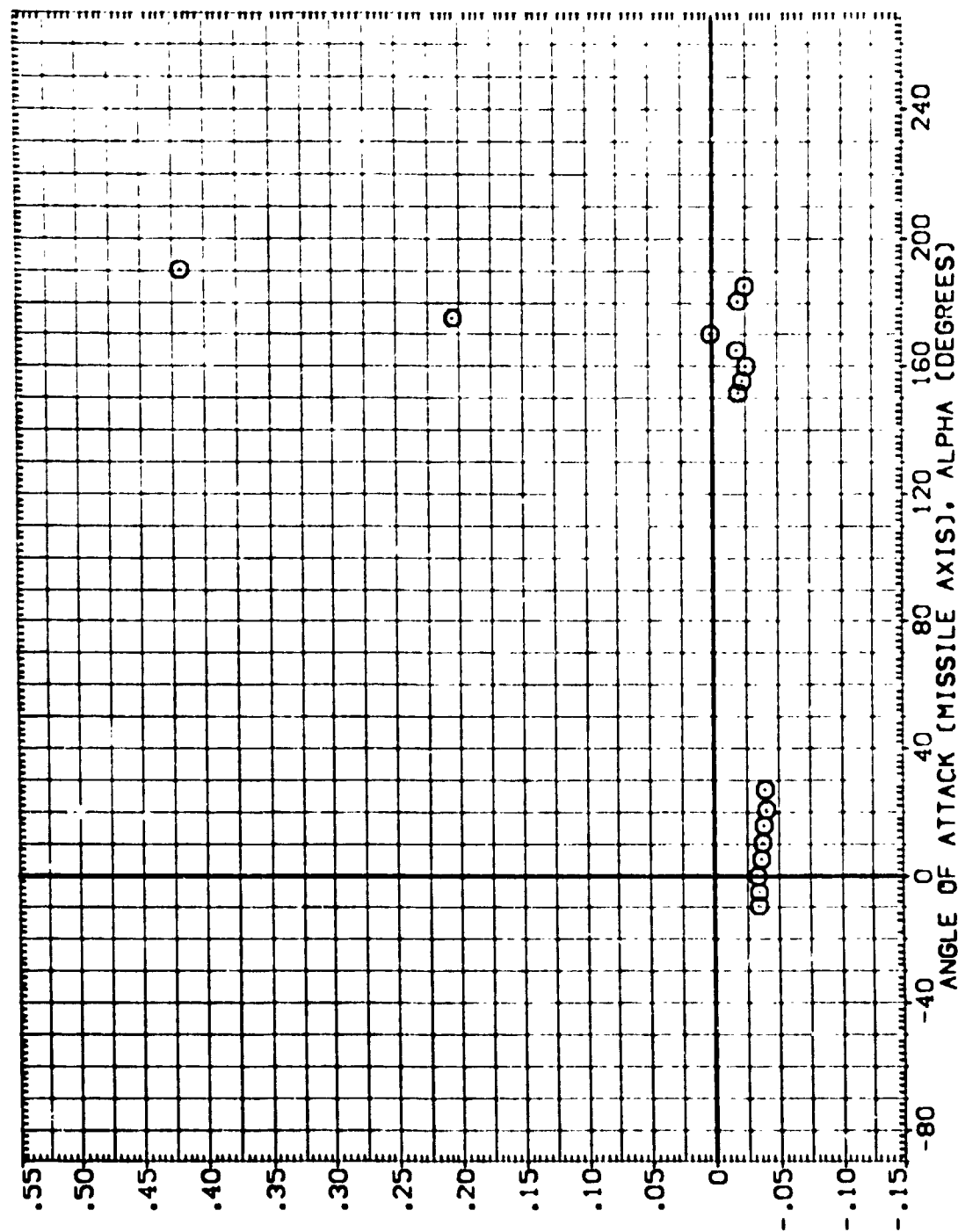


FIG. 6 COEFFICIENT'S VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMO4)

O
 P-1
 PARAMETRIC VALUES
 10.400
 TION
 90.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT
 LREF
 BREF
 XREF
 YREF
 ZREF
 SCALE
 1408.
 .1
 .

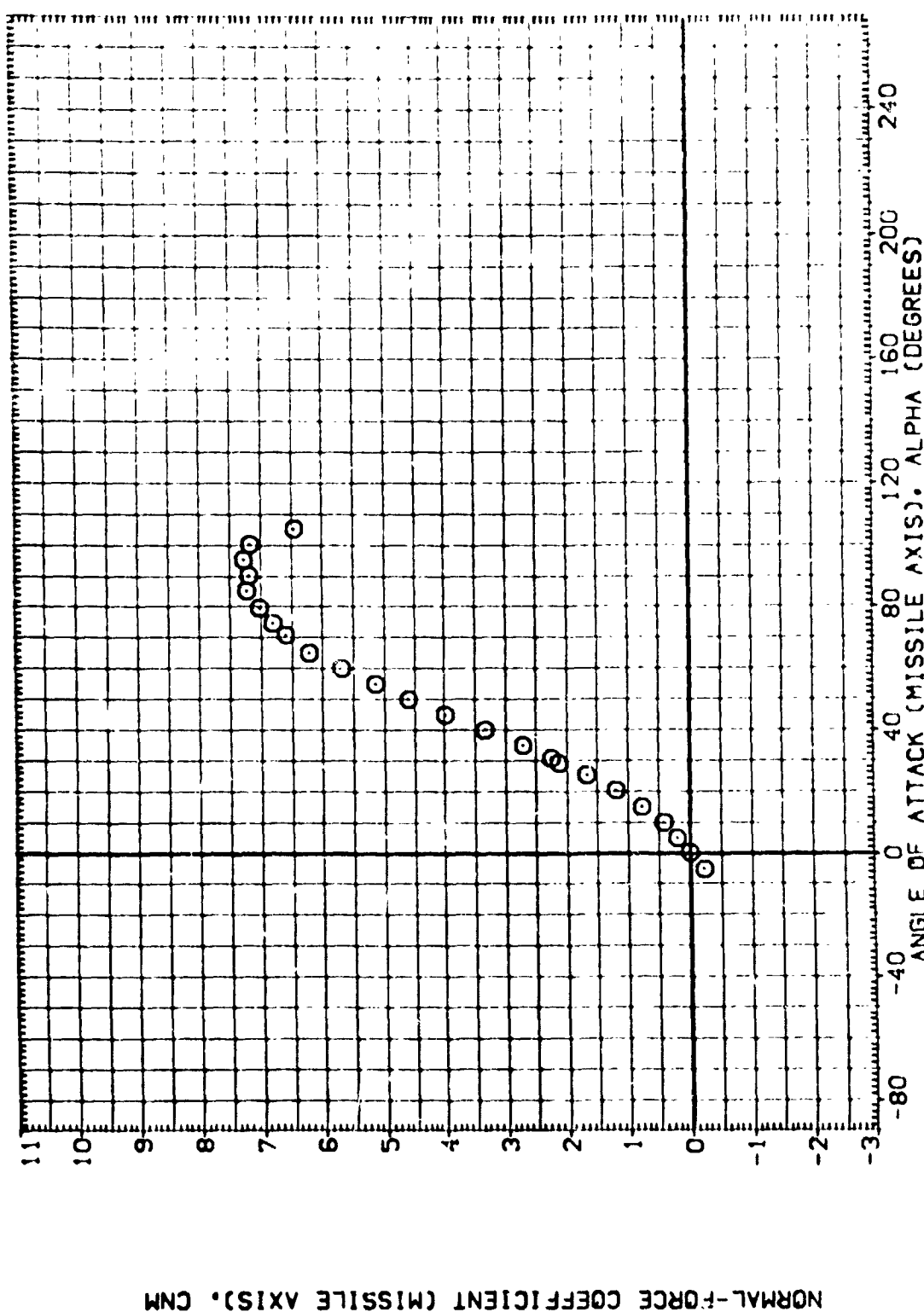


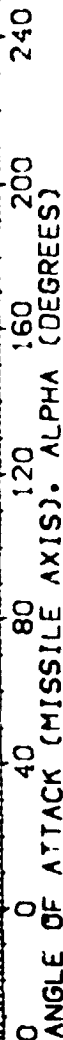
FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

A 3.5-1

•

164
50.51.
11.11.11.
11.11.11.
11.11.11.
11.11.11.

SCALES



PAGE 38

C-2

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYMO4)

S O
PHI

PARAMETRIC VALUES
10.400 RN/L

REFERENCE INF
SREF 594.1360
LREF 330.
BREF 330.
XMRP 1406.
YMRP .
ZMRP .
SCALE .
TION
SQ.FT.
IN.
IN.XT
IN.YT
IN.ZT

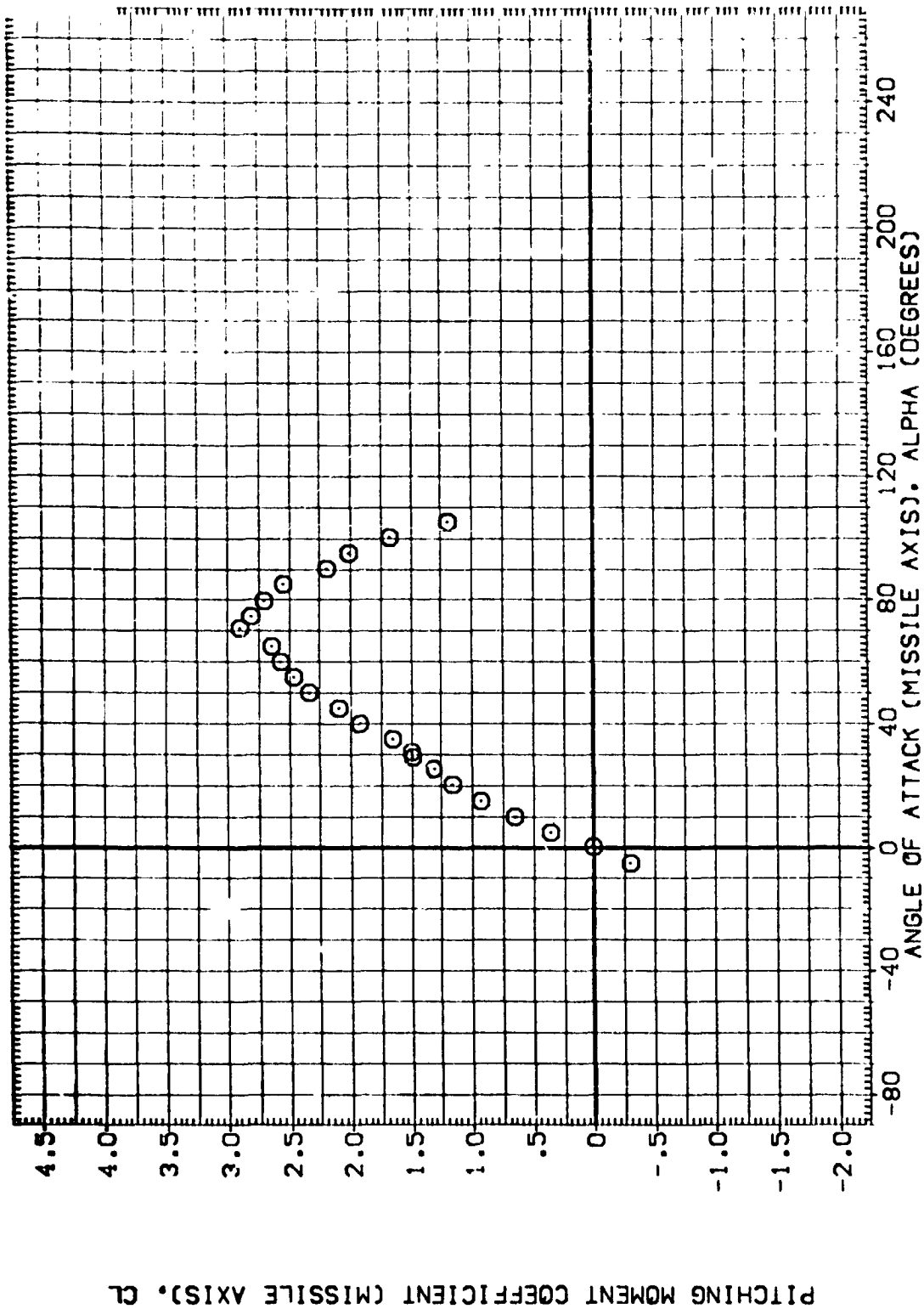


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CCEYM04)

PHI .
 P 10.400
 TRIC VALUES
 RV/L
 SREF 594.1360
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP .
 ZMRP .
 SCALE .
 TION
 SQ.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

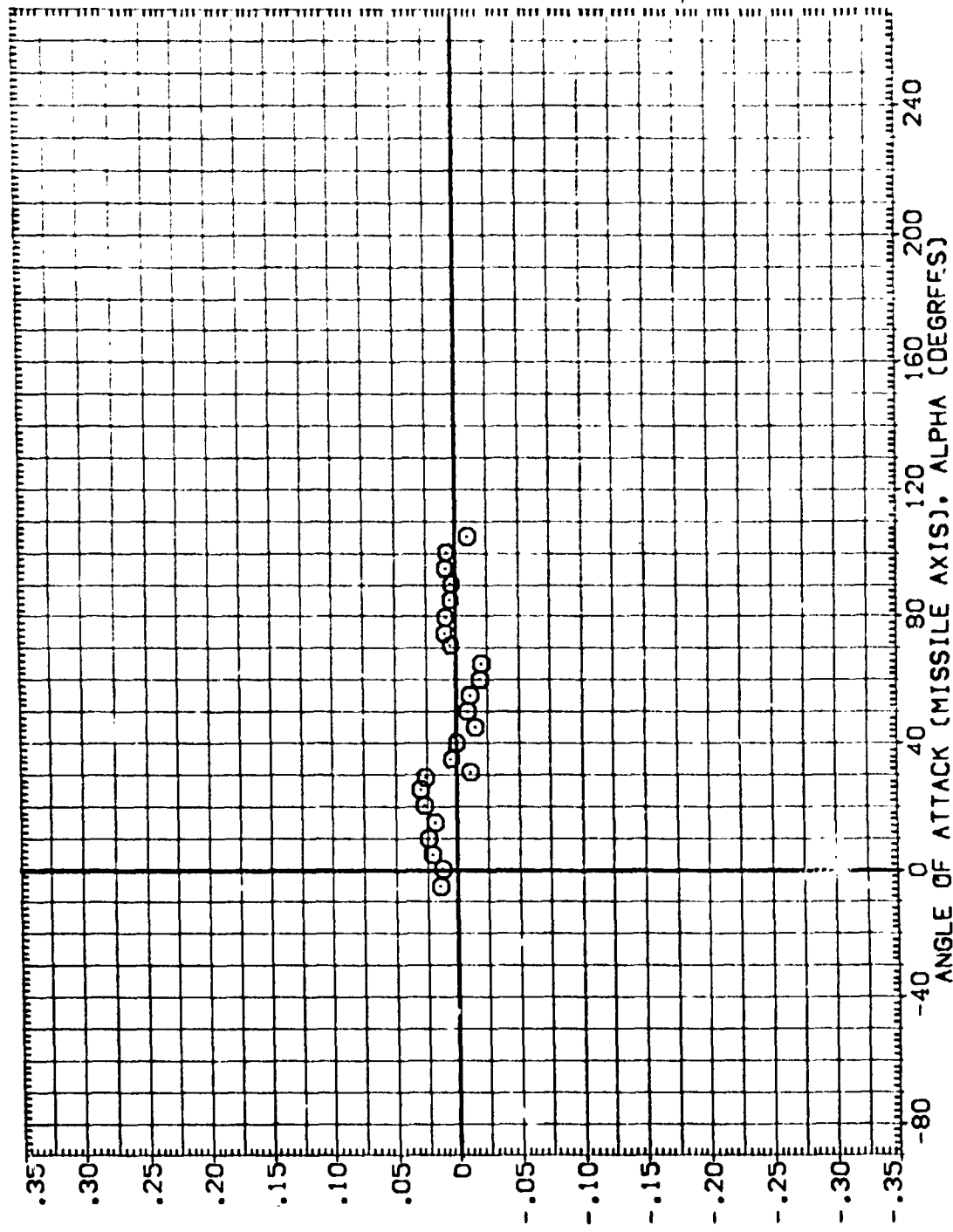


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (CEYMO4)

PHI	.000	MACH	10.400	RM/L	
PARAMETRIC VALUES					
REFERENCE INF					
SREF	594.1360	SQ.FT.			
LREF	330.	IN.			
BREF	330.	IN.			
XMRP	1406.	IN.			
YMRP	.0000	IN.			
ZMRP	.0000	IN.			
SCALE		IN.			

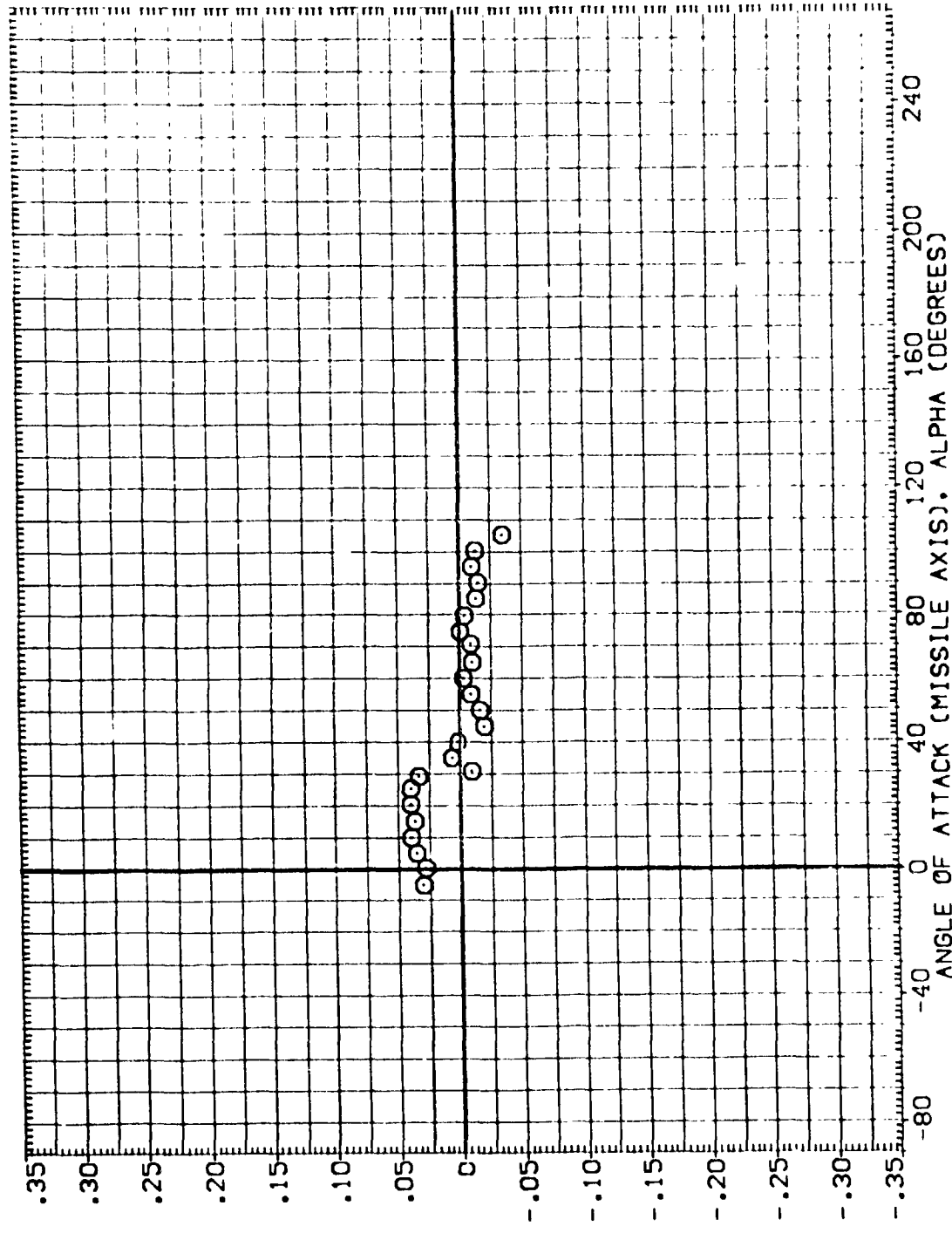


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET CTANK WITH PROTUBERANCES (CEYMO4)

PHI	.000	MACH	0.400	RV/L	.390
PARAMETRIC VALUES					
SREF	594.1360	REFERENCE INF			
LREF	330.2000				
BREF	330.2000				
XMRP	1406.0000				
YMRP	.0000				
ZMRP	.0000				
SCALE	.0060				

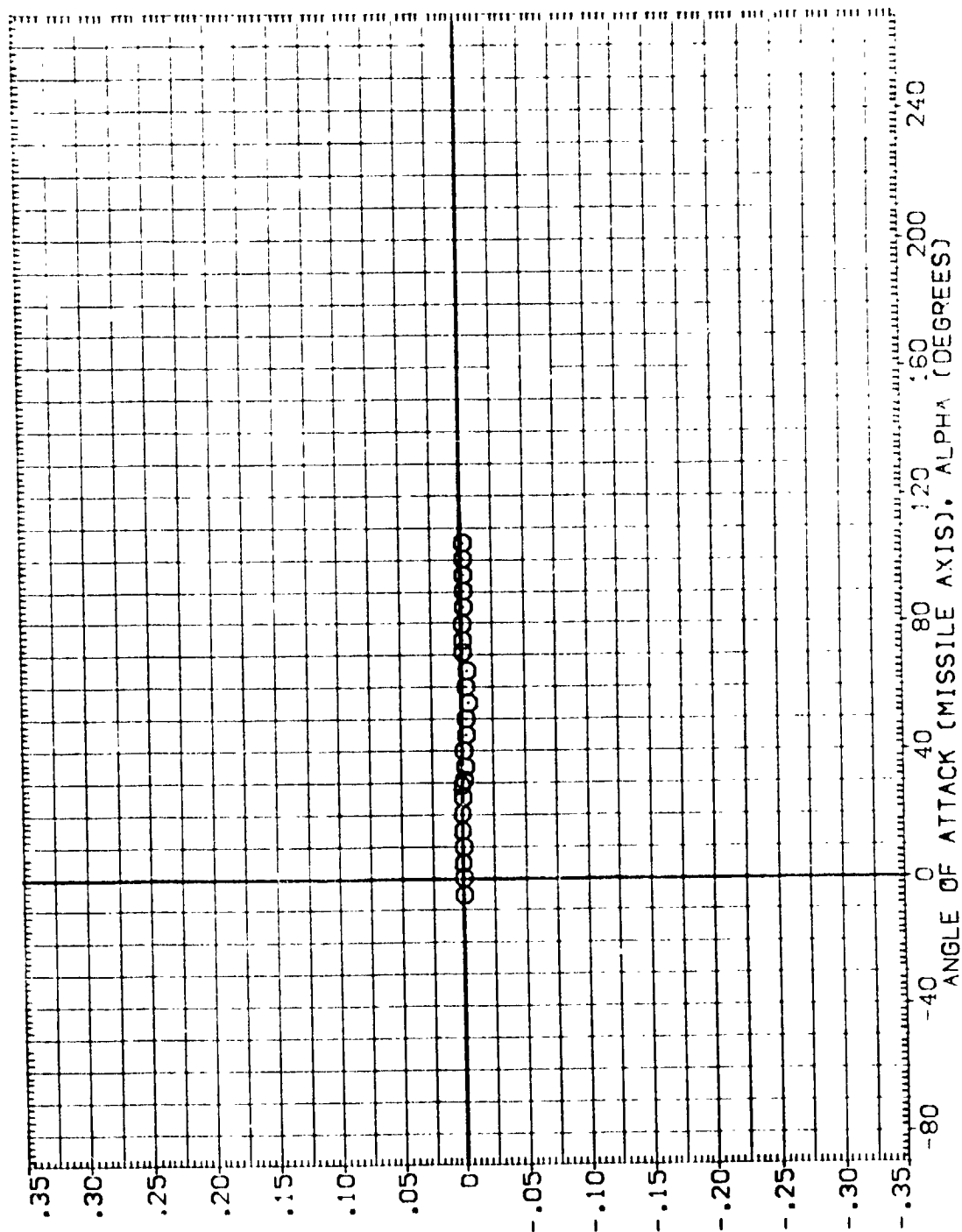


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

[CEYMD4]

PHI	MACH	PARAMETRIC VALUES	REFERENCE IN	TION
0	.000	10.400 RV/L	SREF 594.1360	SQ.FT.
			LRFF 330.2000	IN.
			BREF 330.	IN.
			XRPP 1406.	IN.XT
			YMRP .0000	IN.YT
			ZMRP .0060	IN.ZT
			SCALE	

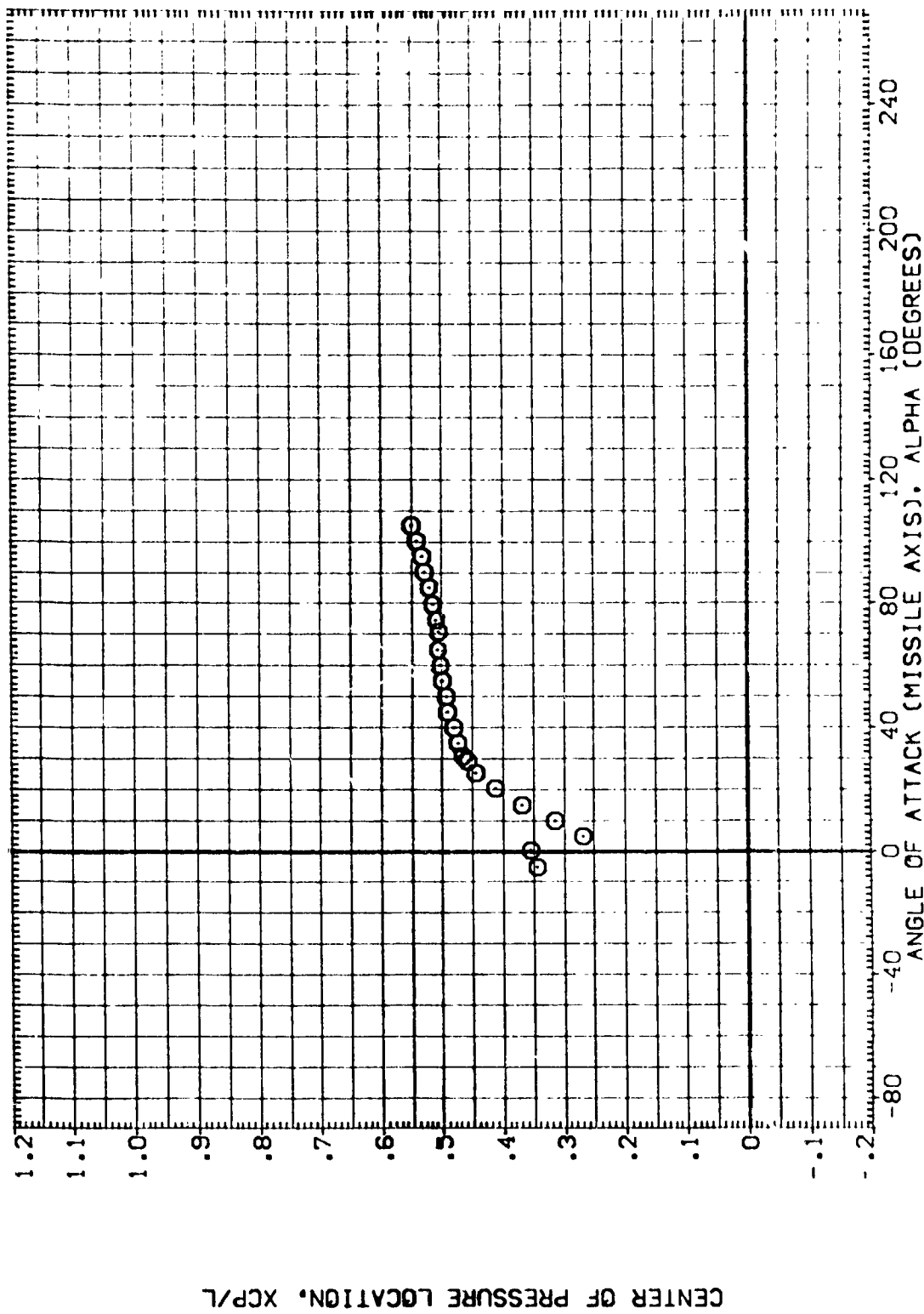


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

REFERENCE	IN	TION
F	594.1	99.FT.
LREF	330.	IN.
BREF	330.	IN.
XMRP	1406.	IN.XT
YMRP	.	IN.YT
ZMRP	.	IN.ZT
SCALE	.	

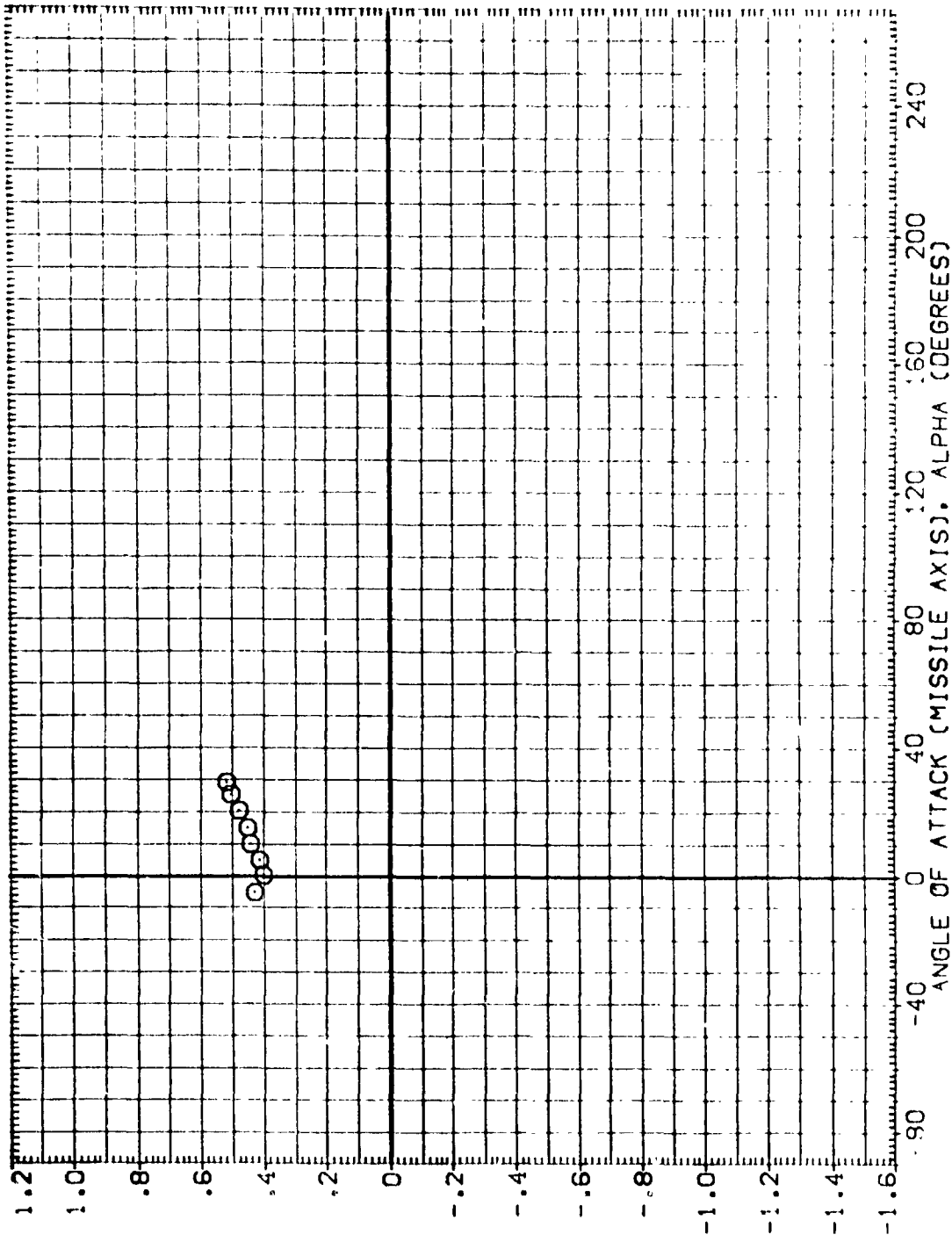


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

PHI . MACH P TRIC VALUES .

SREF	594.1360	TION
LREF	330.	SO.FT.
BREF	330.	IN.
XMRP	1406.	IN.XT
YMRP	.	IN.YT
ZMRP	.	IN.ZT
SCALE	.	

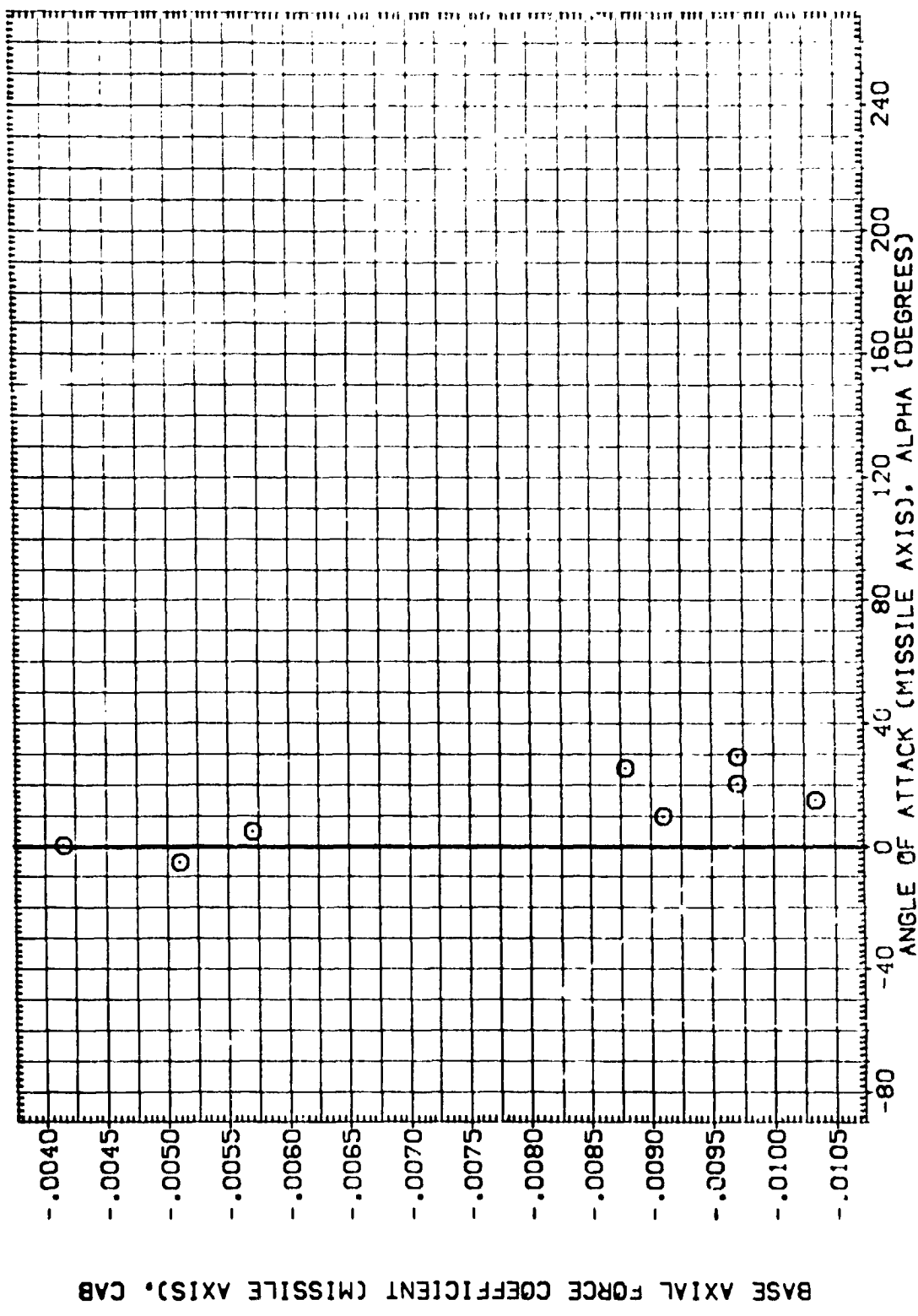


FIG. 7 COEFFICIENTS VERSUS ANGLE OF ATTACK

(CEYMO5)

一、

P	TRIC VALUES
10.400	1.740

SREF
LREF
BREF
XMRP
YMRP
ZMRP
SCALE

SG. FT. X Y Z
I I I I I

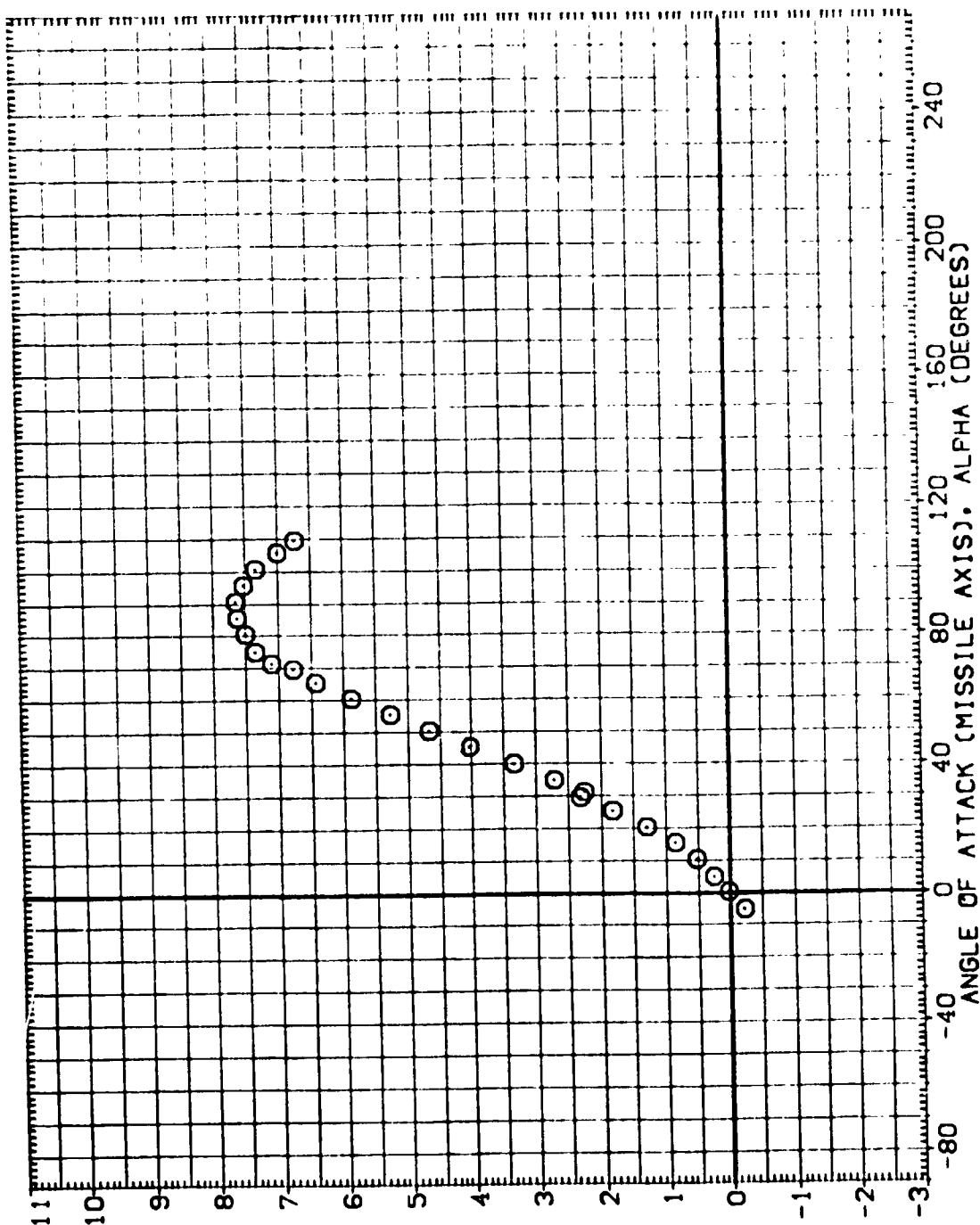


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (CEYMC5)

PHI .
 PARAMETRIC VALUES
 10.400 RN/L 1.740
 REF 594.1
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP .
 ZMRP .
 SCALE .
 TION 50.FT.
 IN.
 IN.
 IN.
 IN.
 IN.
 IN.

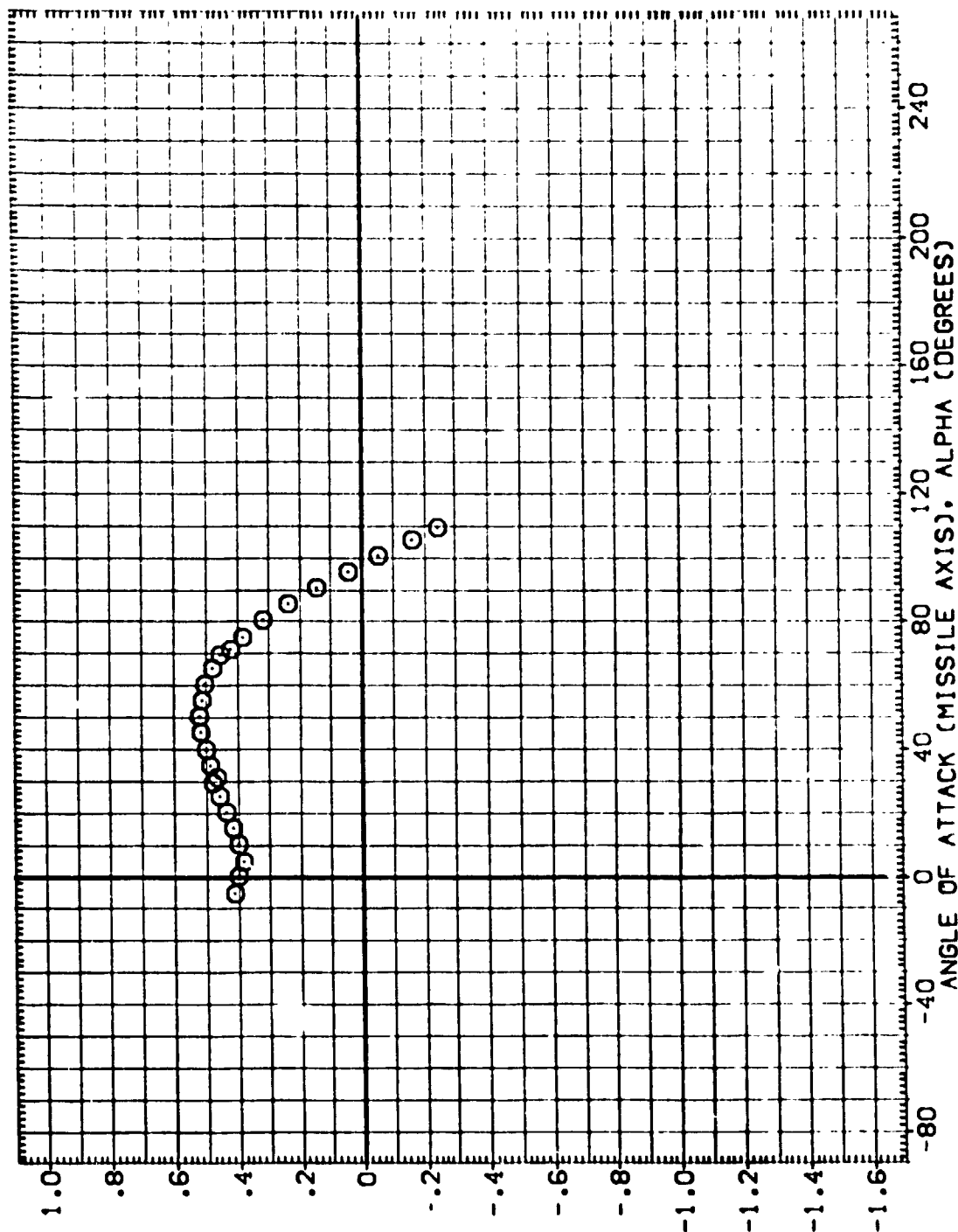


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

	P	TRIC V	I	N	ZT
O .	PHI	10.400	1.740	.1	SQ.FT.
				.	N.N.
				.	N.XY
				.	N.YT
				.	N.ZT
				1408	
				F	
				LREF	
				BREF	
				SCALE	

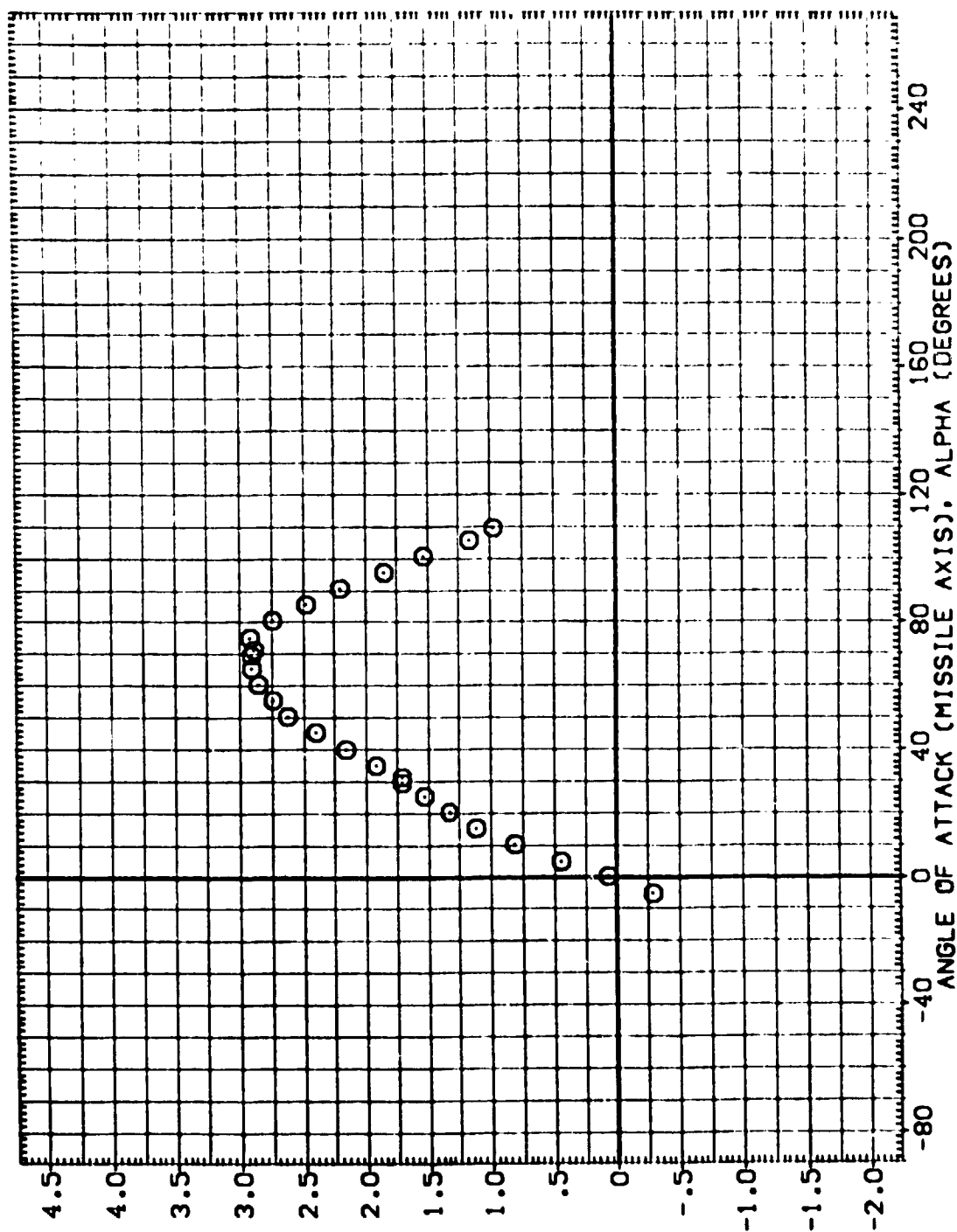


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES) (CEYM05)

O
 PHI
 P 10.400 TRIC V S 1.740
 REFERENCE INF
 LREF F 1406
 TION
 80.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT
 SCALE : :

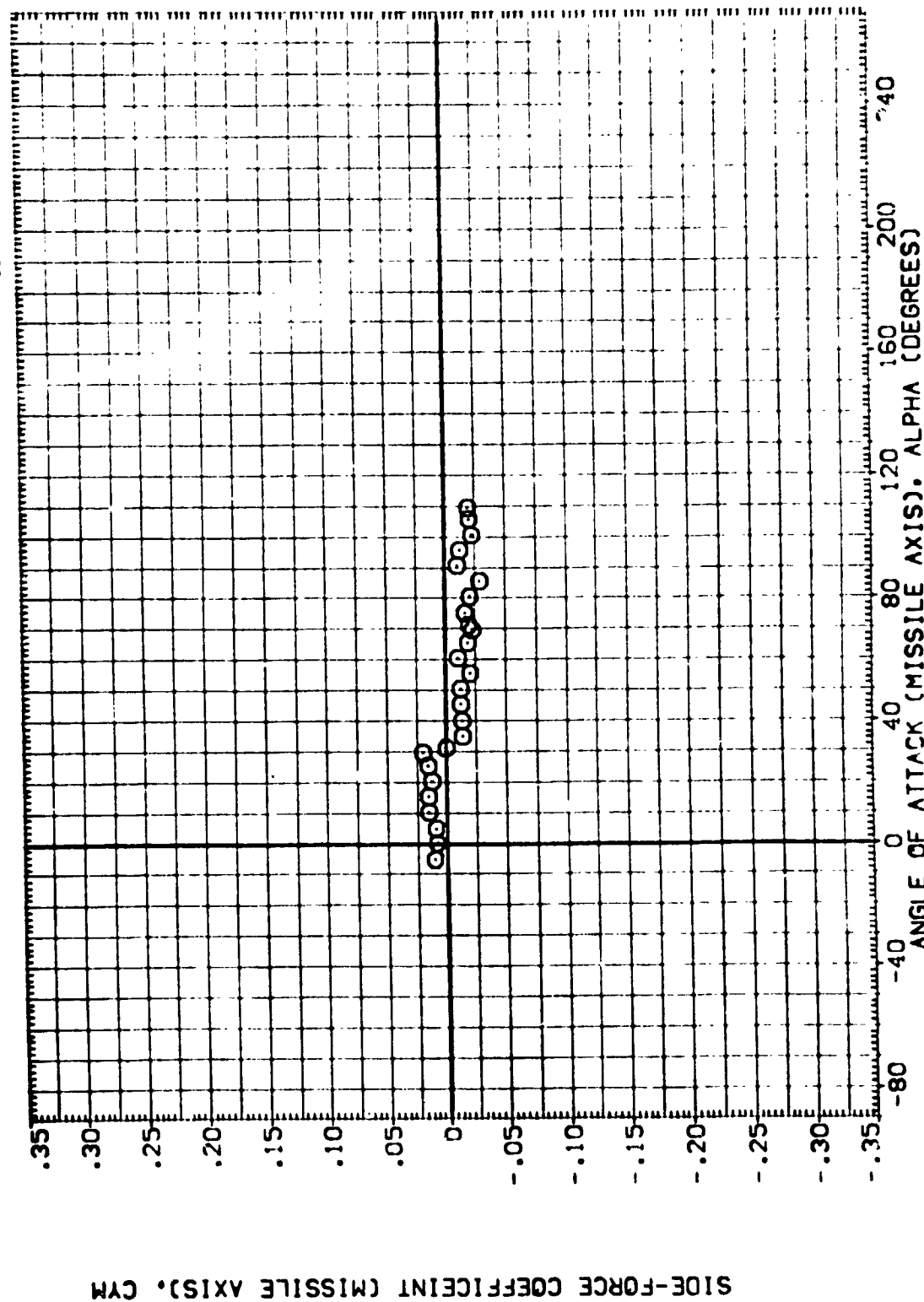


FIG. 8 COEFFICIENTS VE US ANGLE OF ATTACK

1
330.
106.
. .
59.FT.
N.N.N.N.N.

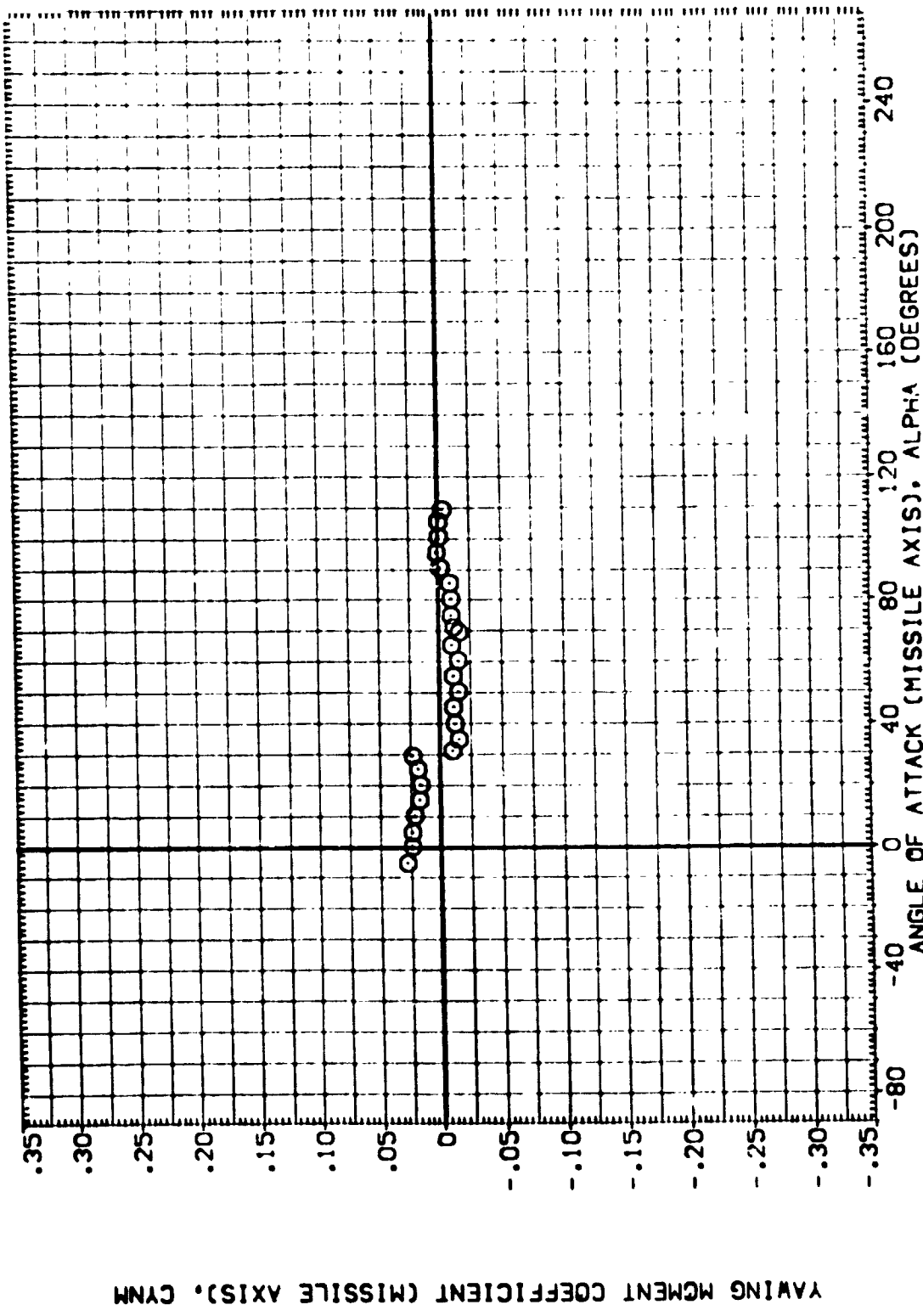


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES)

PARAMETRIC VALUES
10.400 RM/L

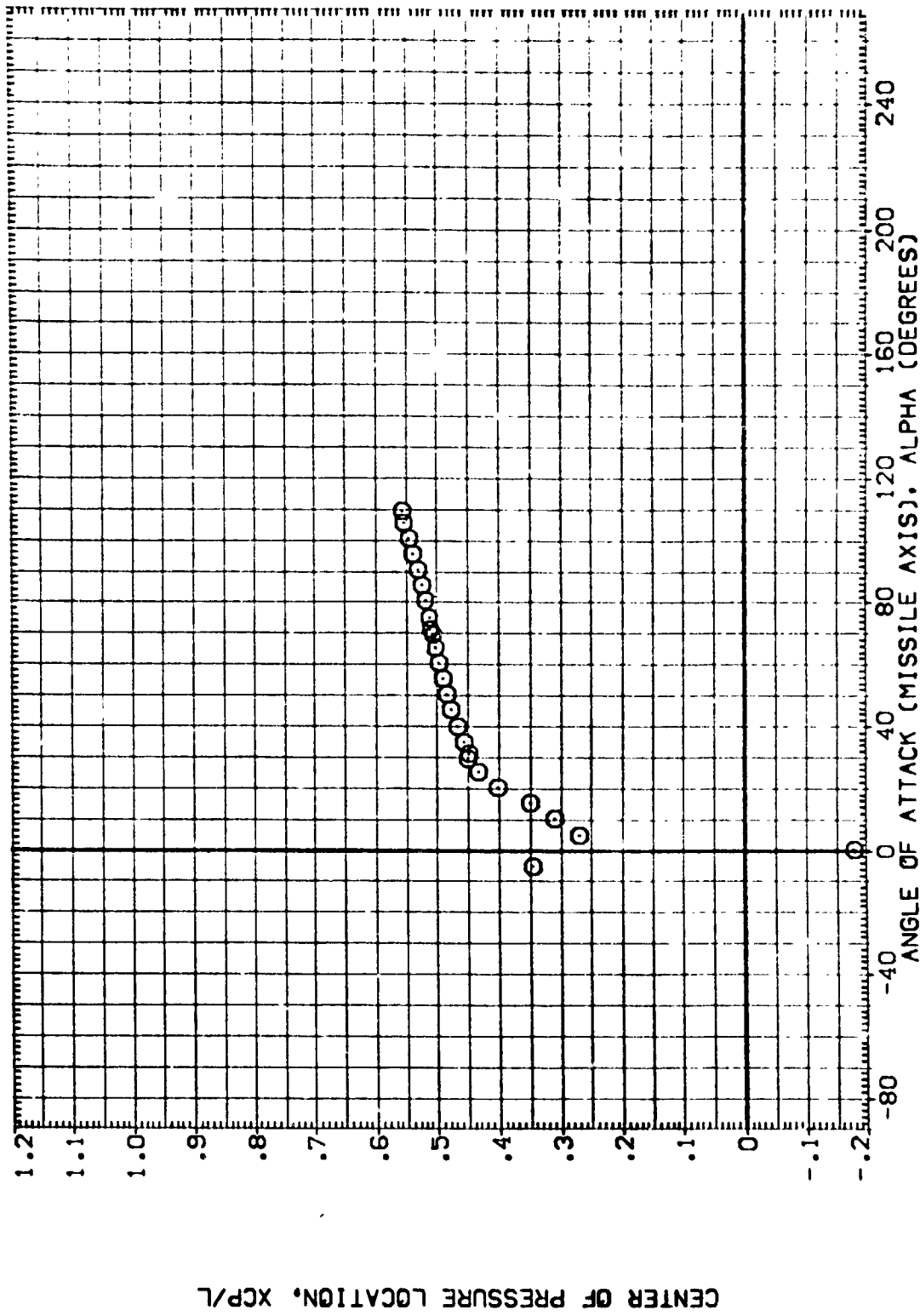


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

(BEYMA5)

	MACH	PARAMETRIC VALUES	REFERENCE INF	TION
PRI .			SREF 594.1	SO.FT.
		10.4UW	LREF 330:	N.
		RN/L	BREF 330:	N.XT
			XMRP 1406:	N.YT
			YMRP :	N.ZT
			ZMRP :	
			SCALE :	

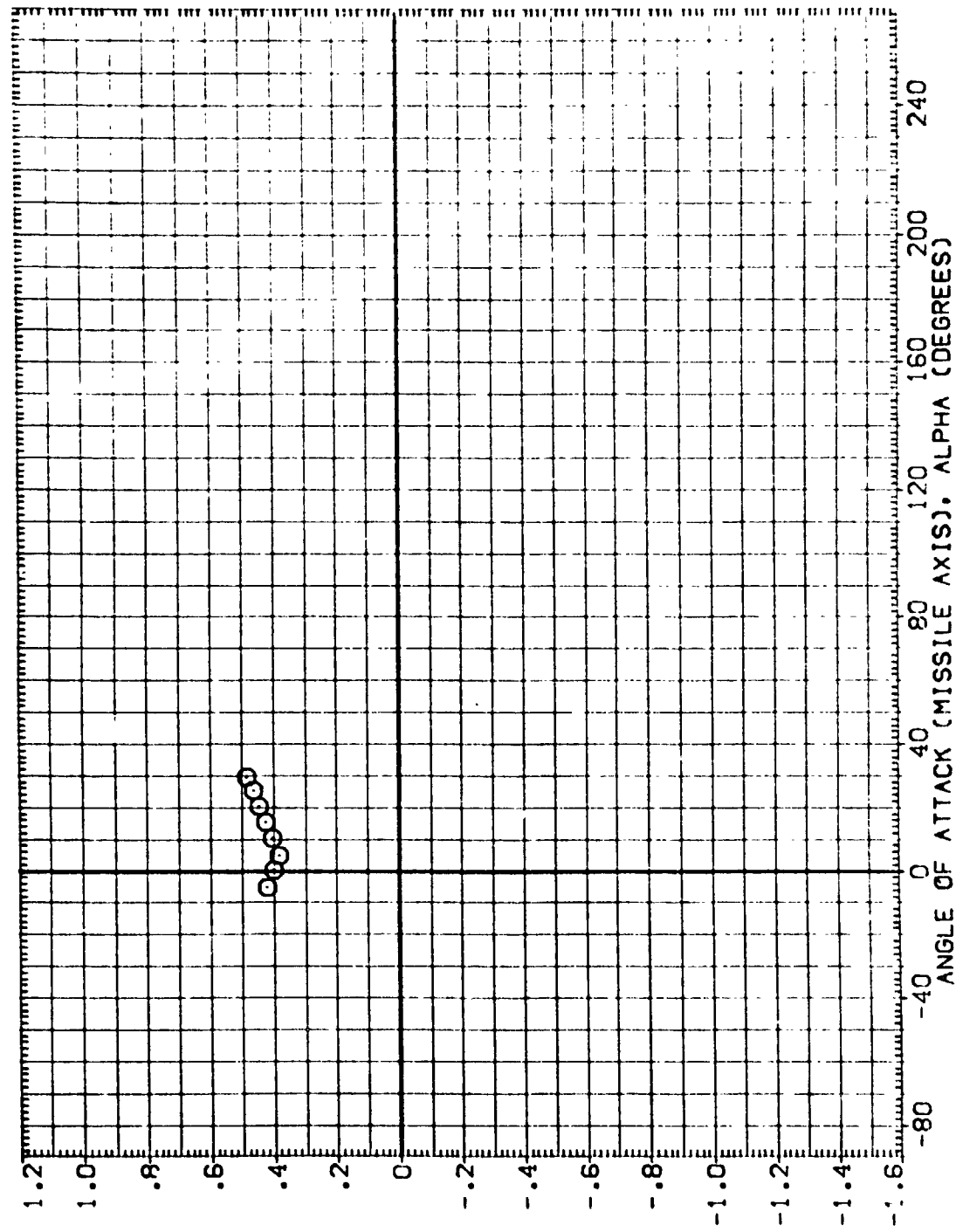


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (BEYMAS)

PHI

0

P

10.400

TRIC VALUES

1.740

REFERENCE INF

594.1

TION

50.FT.

SREF

330.

LREF

330.

BREF

330.

XMRP

1406.

YMRP

.

ZMRP

.

SCALE

.

IN.

IN.

IN.

IN.

IN.

IN.

IN.

IN.

IN.

IN.

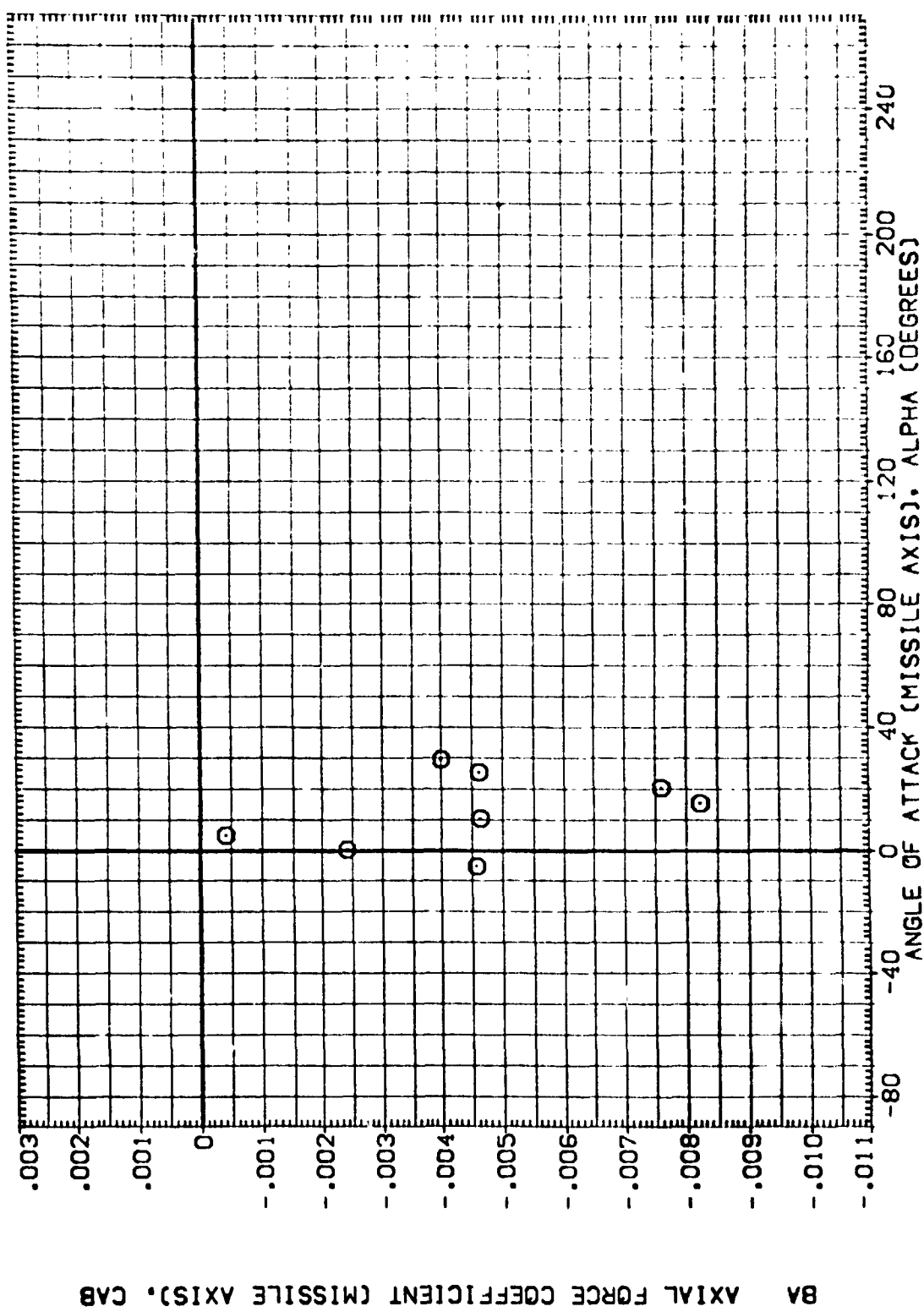


FIG. 8 COEFFICIENTS VERSUS ANGLE OF ATTACK

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA	MACH	PARAMETRIC VALUES	REFERENCE INFORMATION
-5.000	10.400	RN/L	SREF 594.1360
.000	1.160		LREF 330.
5.000			BREF 330.
10.000			XMRP 1406.
			YMRP .
			ZMRP .
			SCALE .

○ □ ◇ △

NORMAL-FORCE COEFFICIENT (MISSILE AXIS), CNM

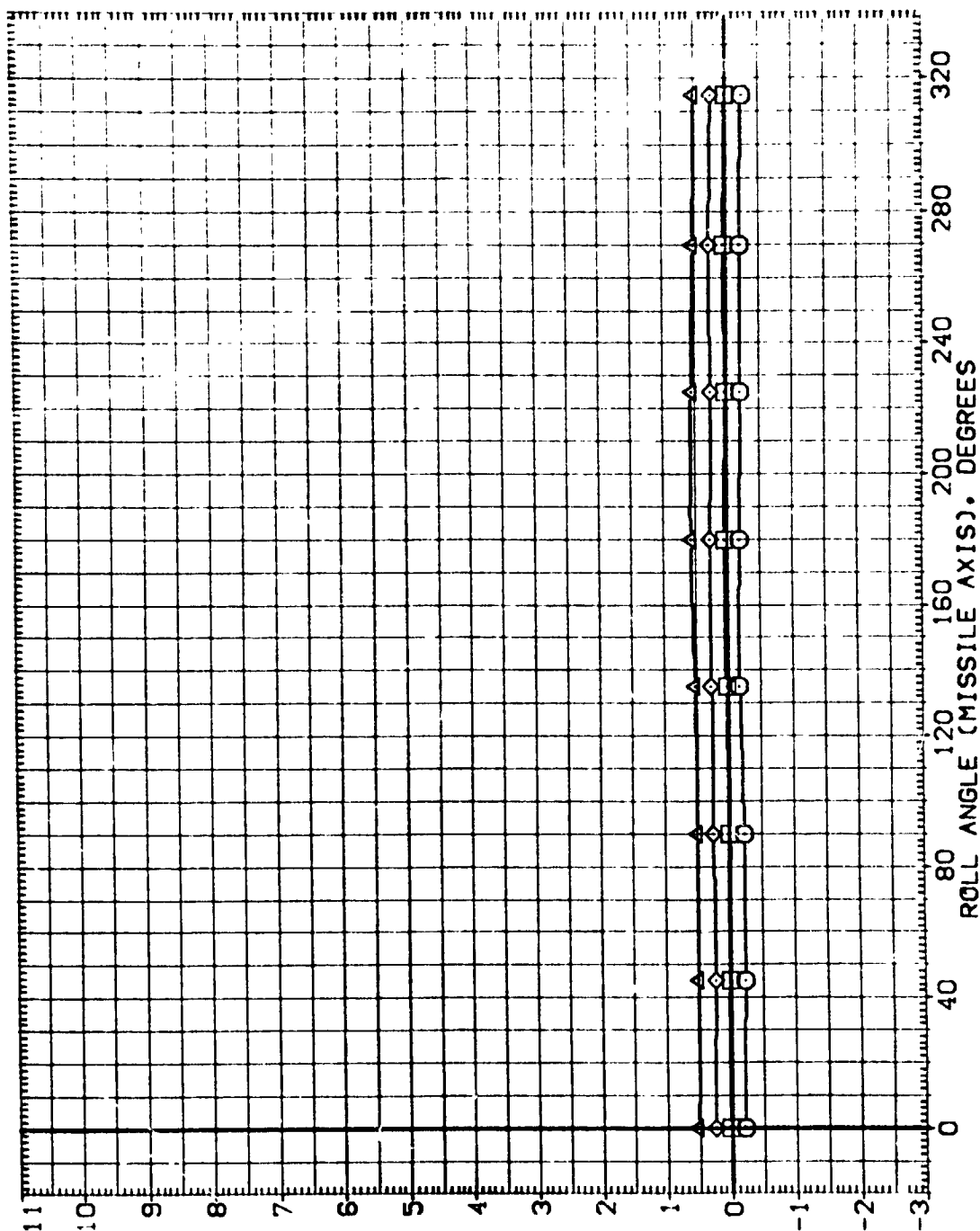


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMC1)

P 10.400
 IC VALUES 1.160
 RE 1
 F 1406
 LREF
 BREF
 XREF
 YREF
 ZREF
 SCALE
 TION
 50.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

15.
 20.
 25.
 30.

◀
 ◻
 ◊
 ◀

NORMAL-FORCE COEFFICIENT (MISSILE AXIS), CNM

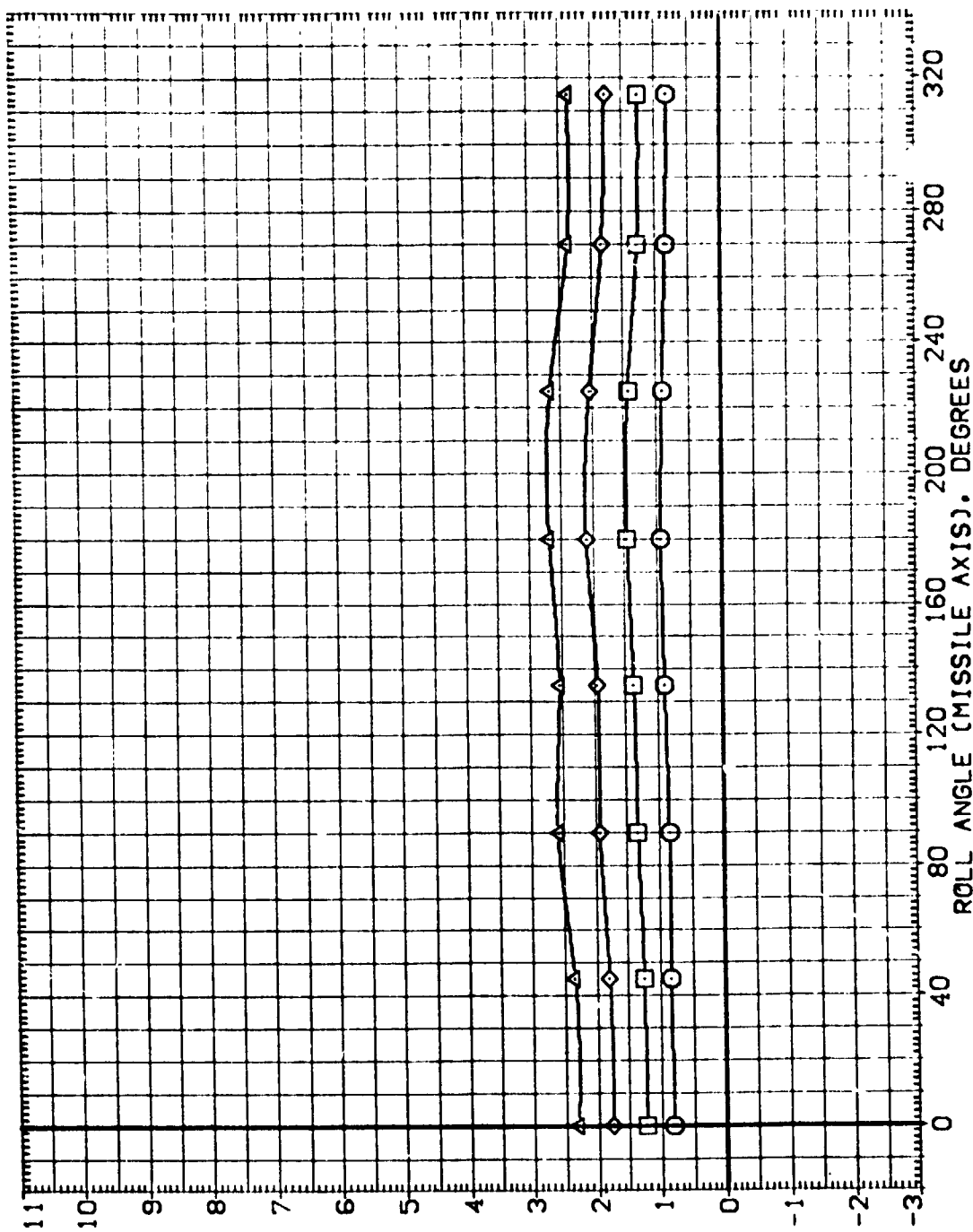


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(NE YMOI)

MACH

SREF	594.1360	TION
LREF	330.2000	SC.FT.
SREF	330.2000	IN.
XREF	1406.0000	N.XT
YREF	.0000	N.YT
ZREF	.0000	N.ZT
SCALE	.0060	

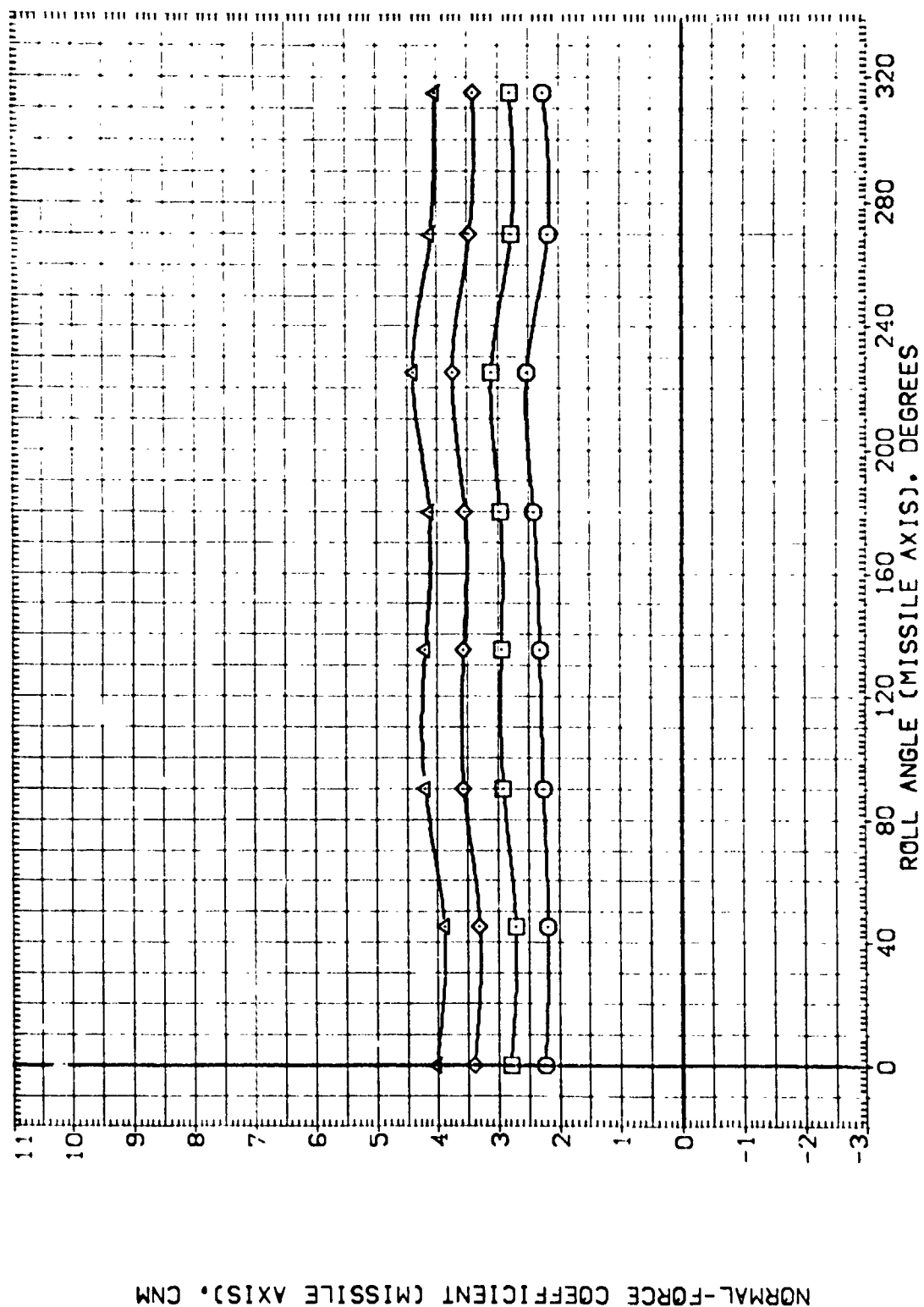


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA 50.000 55.000 60.000 70.000
 S \square \diamond \triangle
 PARAMETRIC VALUES
 MACH 10.400 RN/L 1.160
 REFERENCE INFORMATION
 SREF 594.1360 SQ.FT.
 LREF 330.2000 IN.
 BREF 330.2000 IN.
 YMRP 1408.0000 IN.
 ZMRP .0000 IN.
 SCALE .0000 IN.

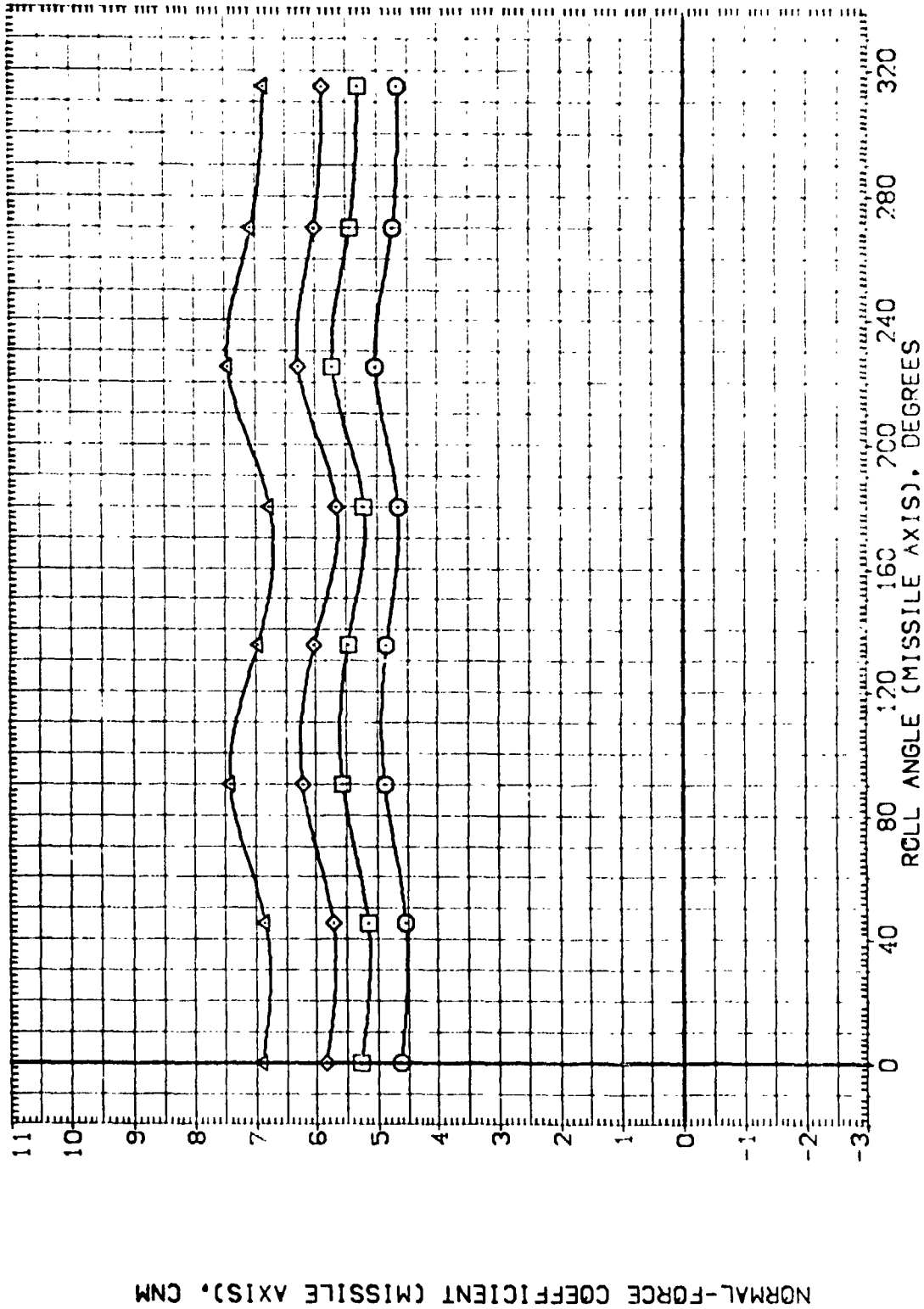


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(NE YMOI)

ALPHA	P	TRIC VALUES	REFERENCE INF	TILN
75.	10.400	RN/L	SREF 594.1	SQ.FT.
80.			LREF 330.	IN.
85.000			BREF 330.	IN.
90.000			XRRP 1406.	IN.XT
			YRRP .	IN.YT
			ZRRP .	IN.ZT
			SCALE .	
	MACH			
			1.160	

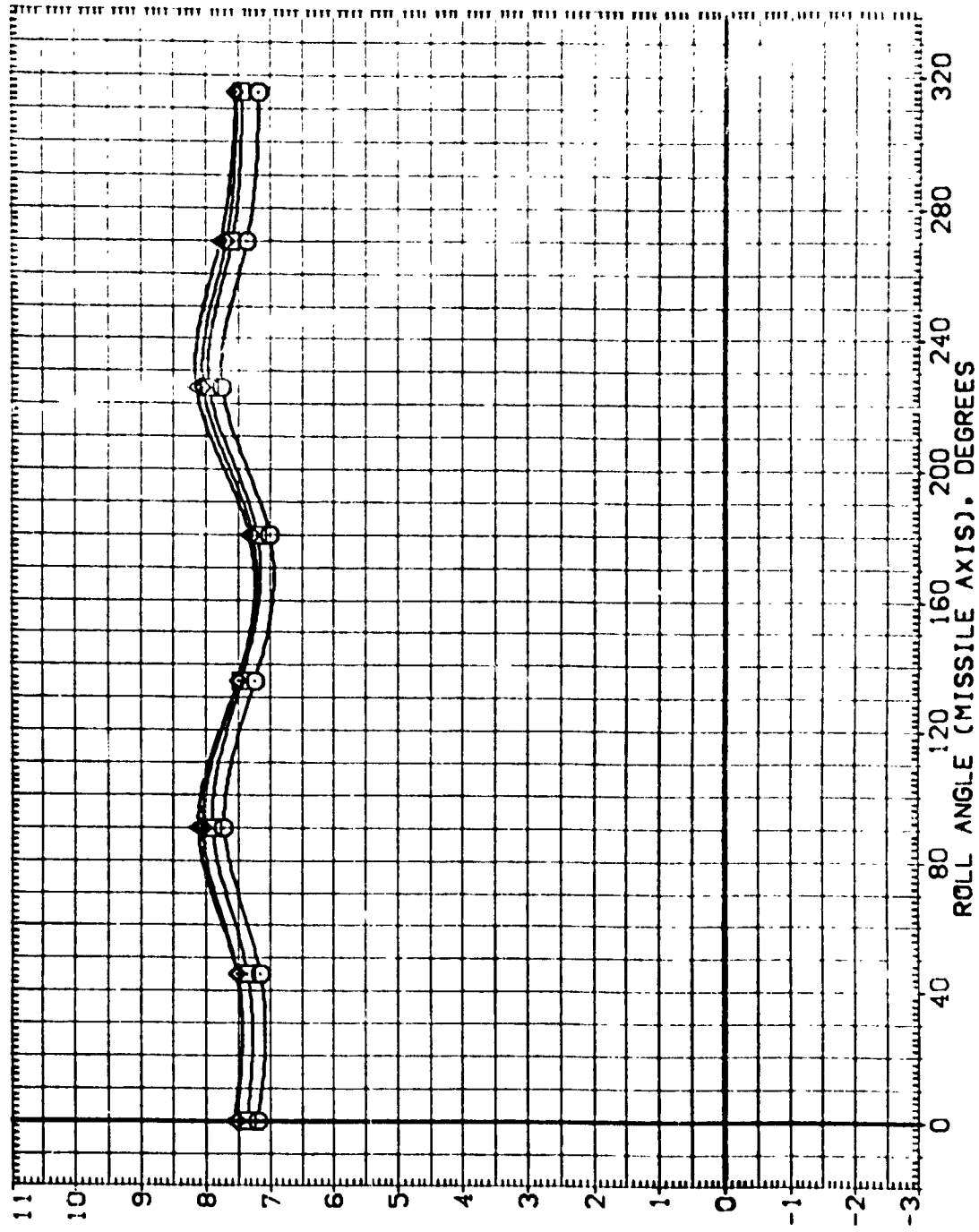


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

55.
 100.
 105.
 110.000

P TRIC VALUES 1.160

9REF
 LREF
 BREF
 XMRP
 YMRP
 ZMRP
 SCALE

10.400 10.400 1.160

90.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

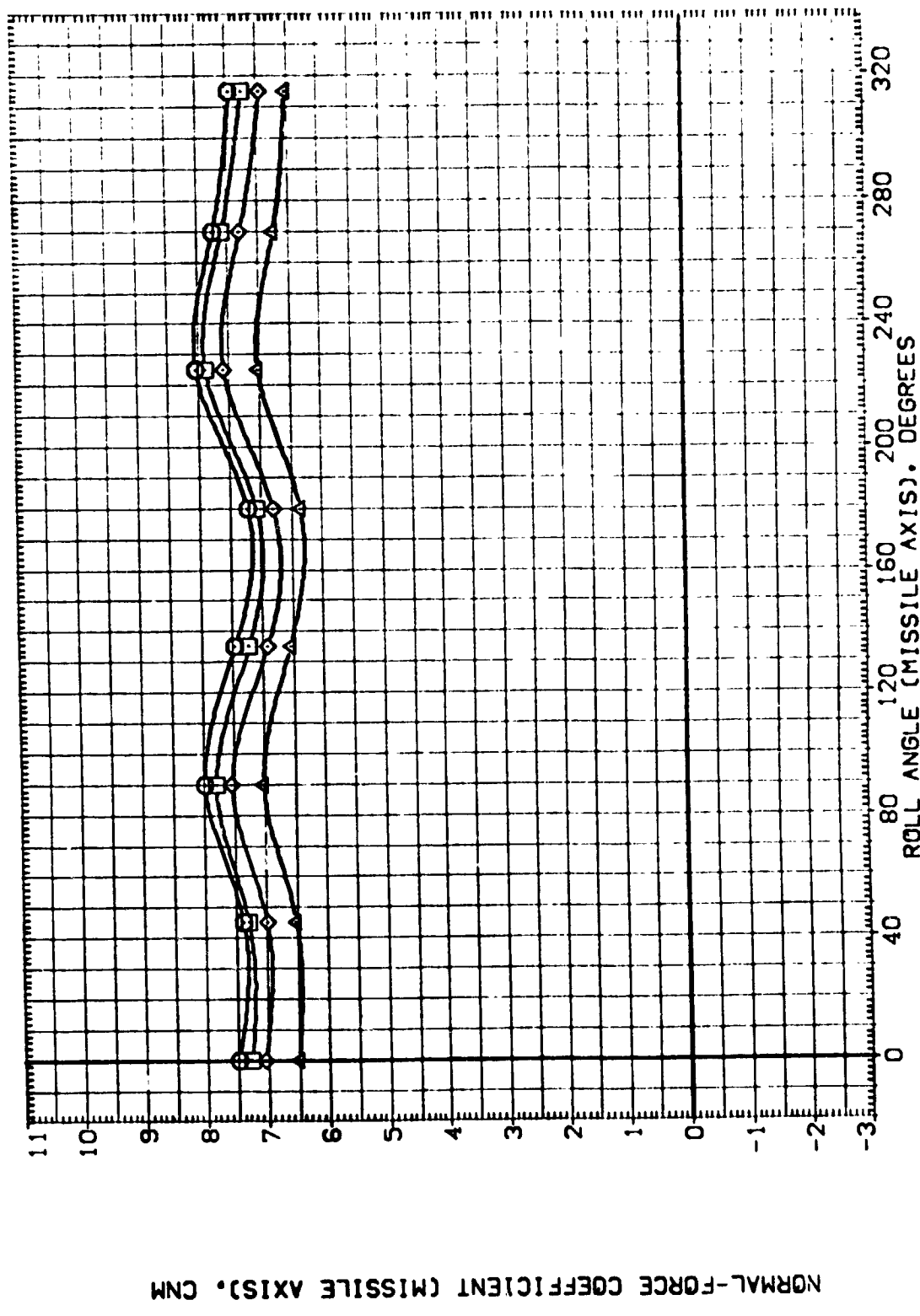


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

APC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES)

□◊◀

ALPHA	P	TRIC VALUES
0.05	0.05	0.05
0.10	0.10	0.10
0.20	0.20	0.20
0.50	0.50	0.50
1.00	1.00	1.00

REFERENCE	1-F
LREF	594.1380
BREF	330.2000
XMRP	330.2200
YMRP	1406.0000
SCALE	.

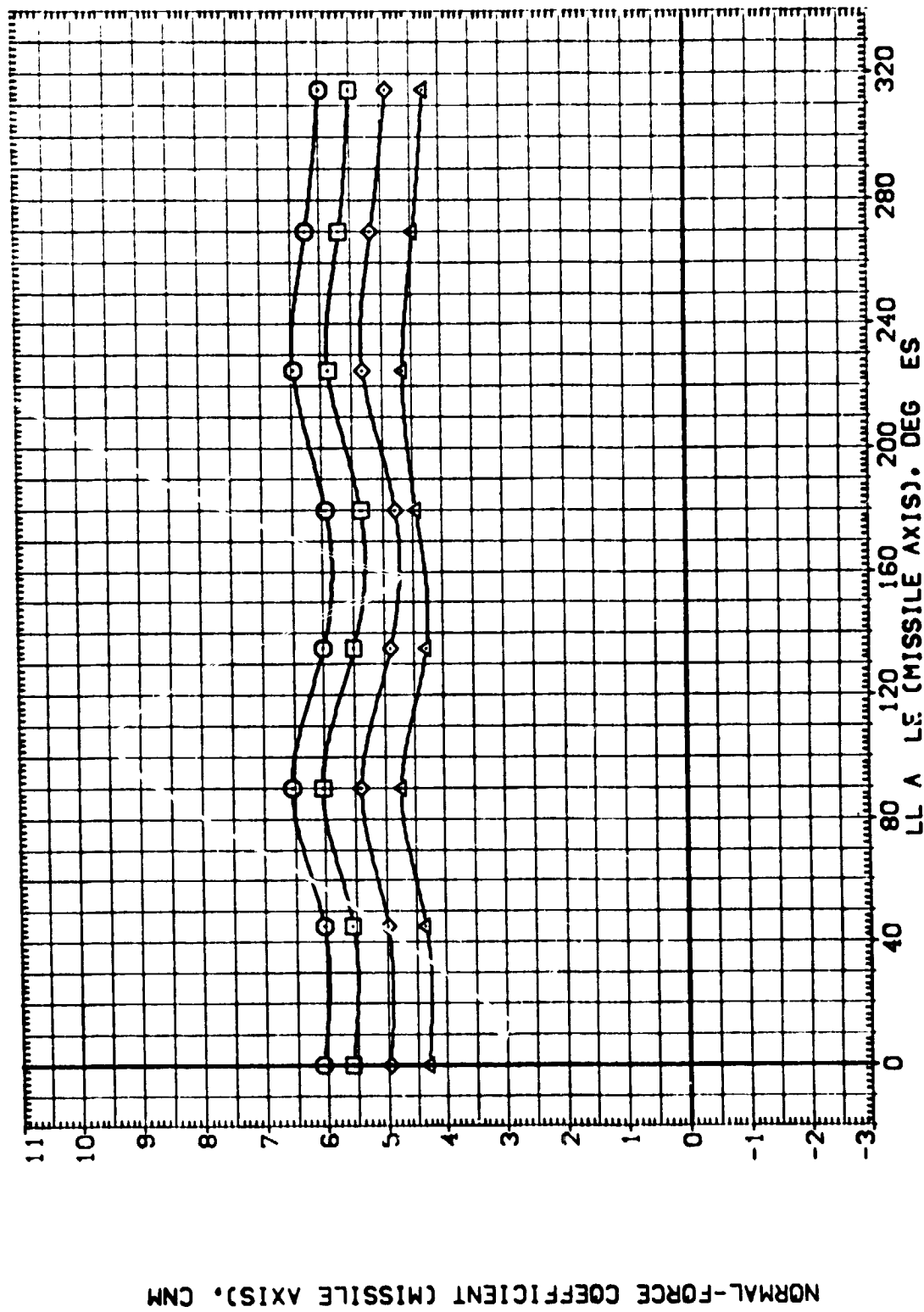


FIG. 9 COEFFICIENTS VE ANGLE OF L

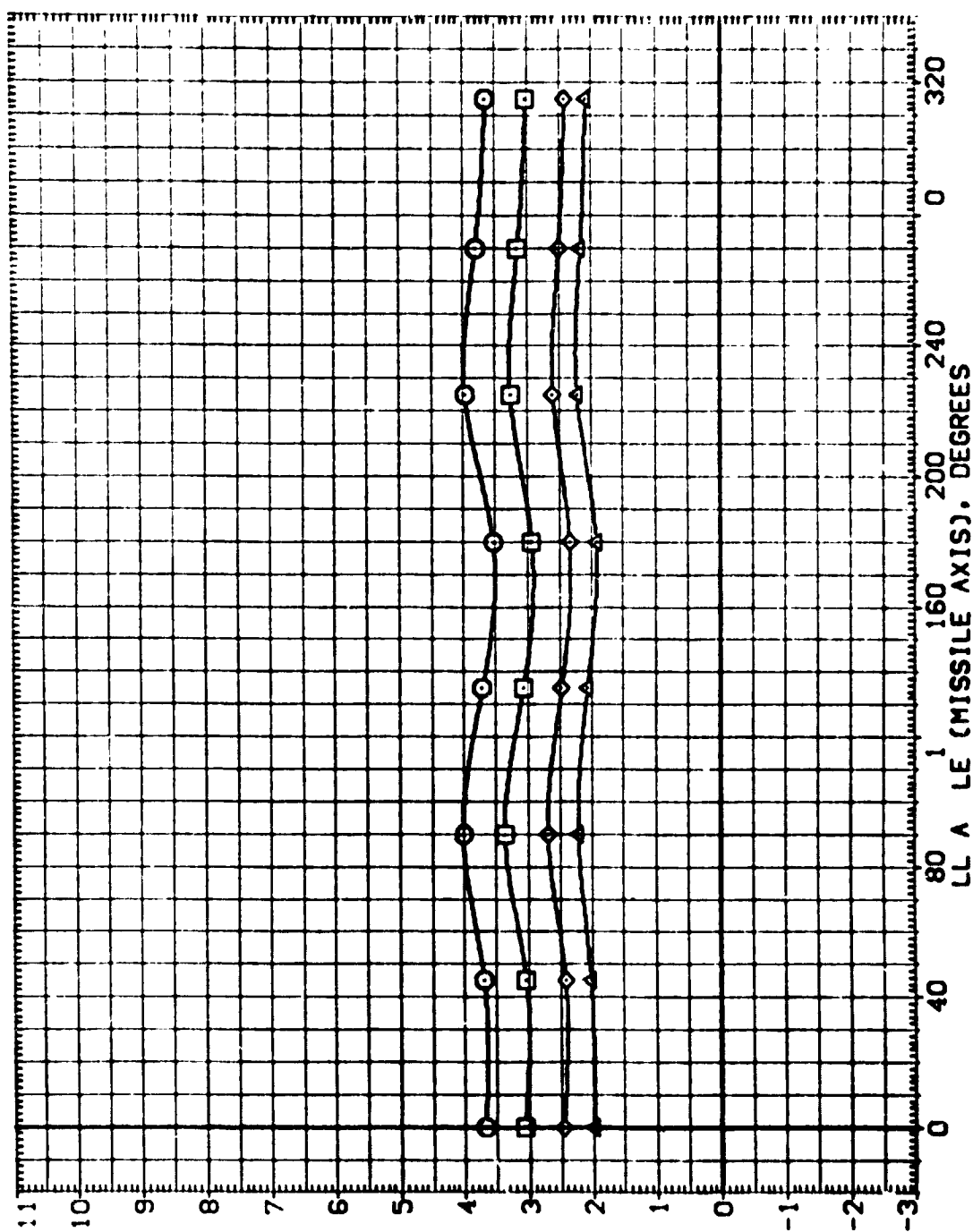
(EYMOI)

SPREF	594.1	IN.	IN.
LRPF	330.	IN.	IN.
BRF	330.	IN.	IN.
XRPF	1406.	IN.	IN.
YRPF	.	IN.	IN.
SCALE	.	IN.	IN.
		IN.	IN.

P	TRIC VALUES
10.400	1.180

□ □ □ □

SCALE



EFFICIENTS VE A E OF L

3.5-196 TA9F ET (TANK WITH P TUBERANCES) (NEYMO1)

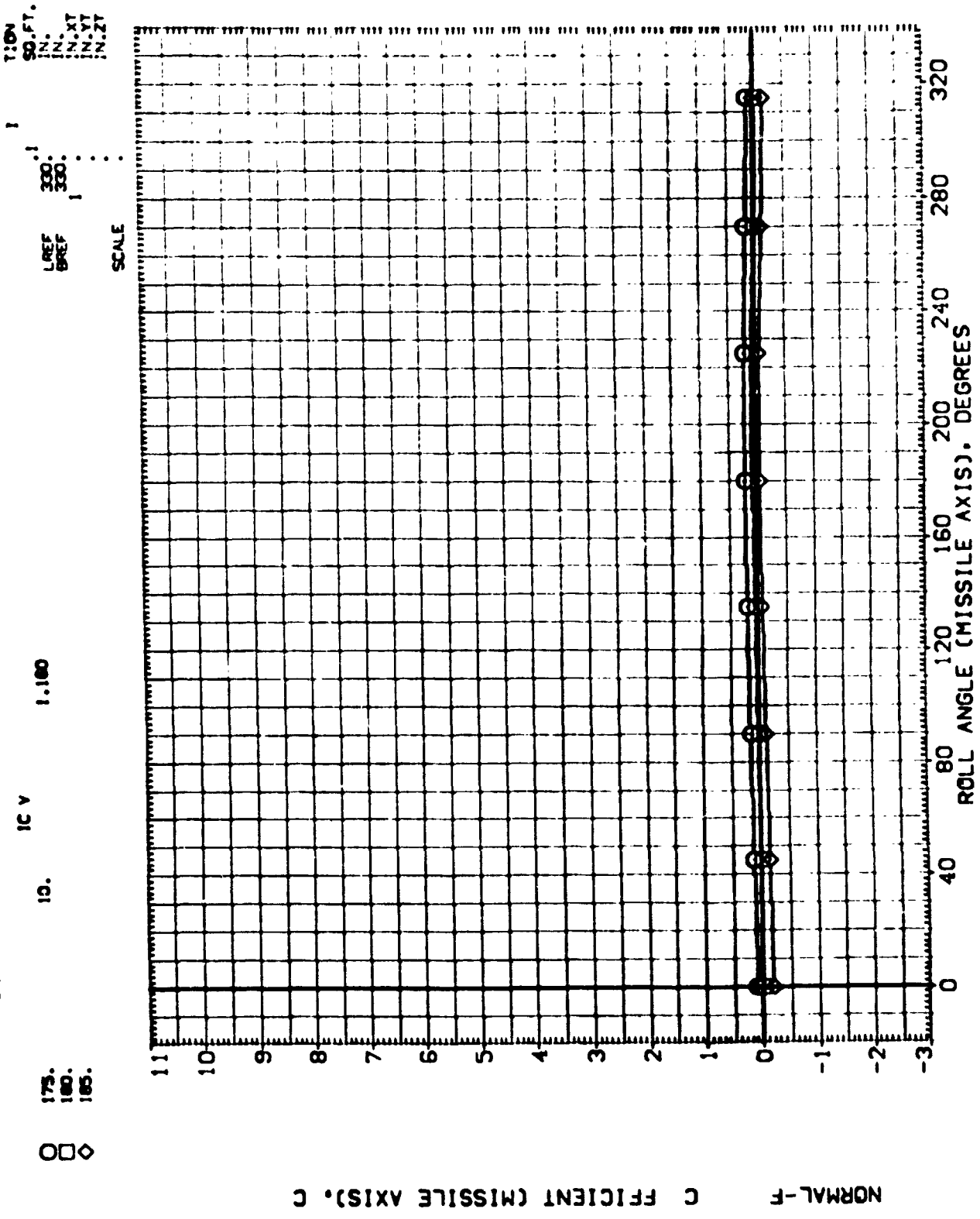


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA
-5.
5.
10.

TRIC VALUES
10. 1.160

REF
F
LINEF
BREF
XREF
YREF
1406

TION
SQ.FT.
IN.
IN. XT
IN. YT
IN. ZT

SCALE

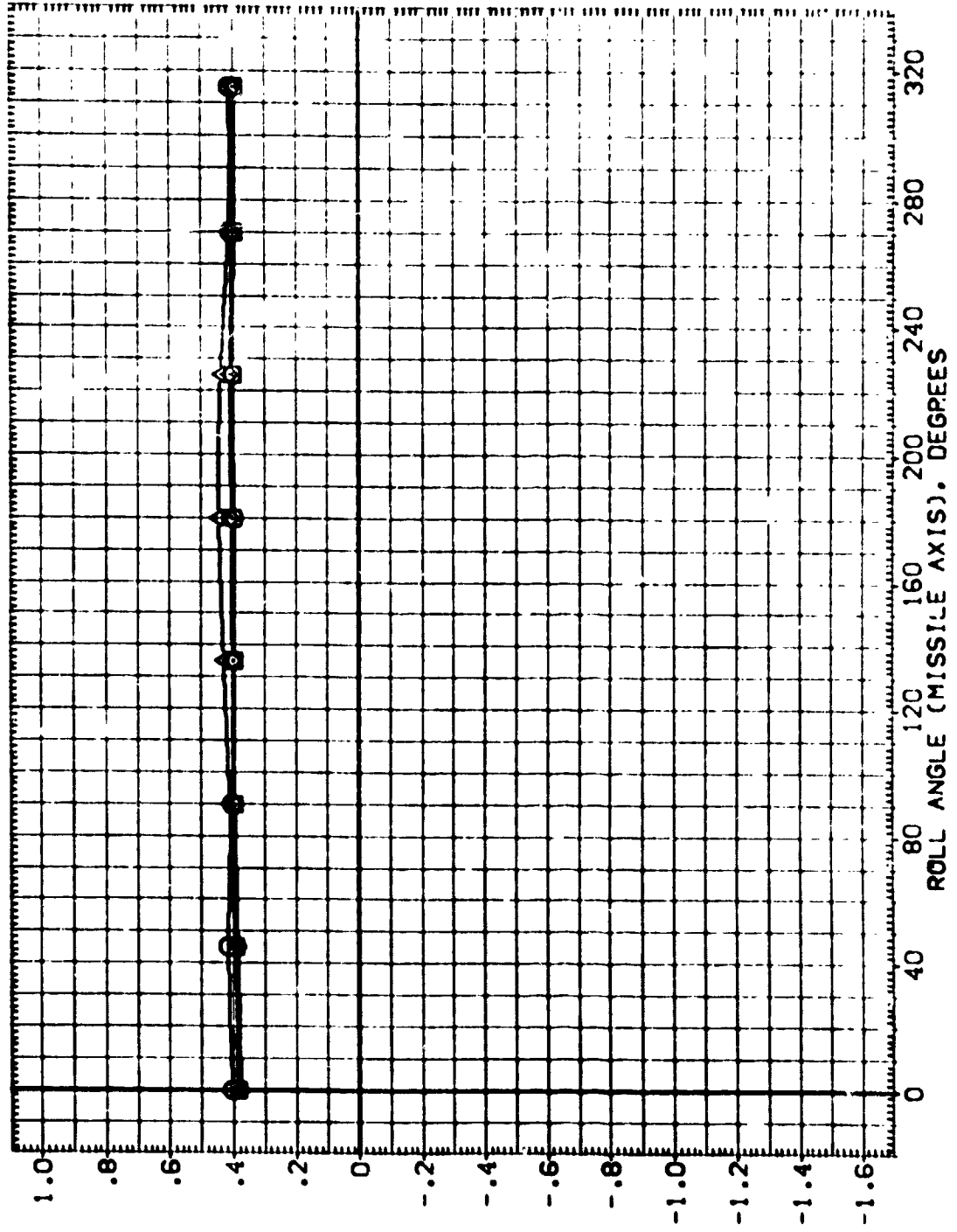


FIG. 9 COEFFICIENTS VE US ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH P TUBERANCES) (NEYM01)

15. \square \diamond \triangle
 20. \square \diamond \triangle
 25. \square \diamond \triangle
 30. \square \diamond \triangle

P 10.400 TRIC VALUES 1.160
 SREF 594.1
 LREF 330.
 BREF 330.
 XMRP 1405.
 YMRP .
 ZMRP .
 SCALE .

REFERENCE 1
 594.1
 330.
 330.
 1405.
 .
 .
 .

TION
 50.FT.
 IN.
 IN.
 IN.
 IN.
 IN.
 IN.

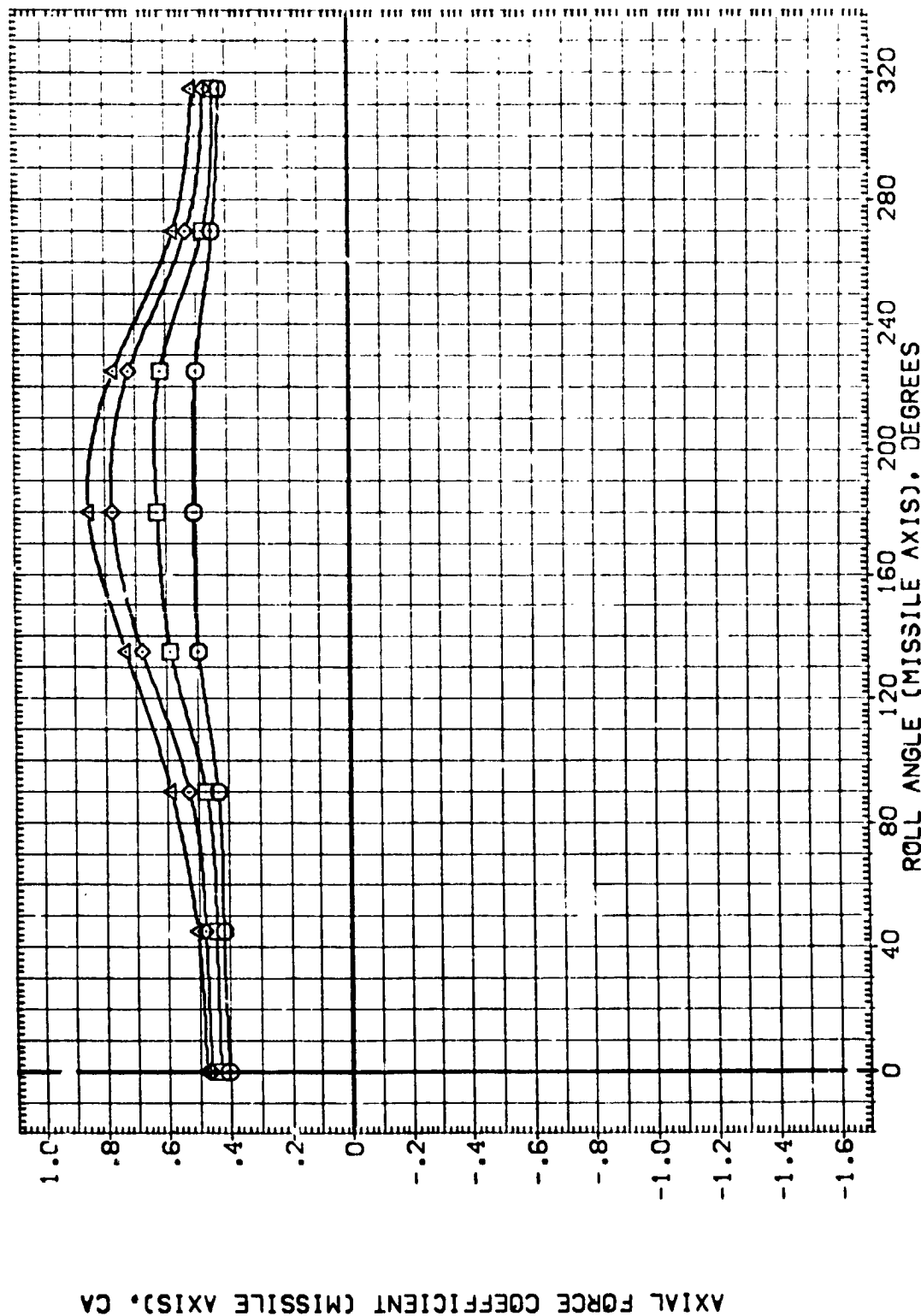


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

{ NE YMO : }

ALPHA
30.000
35.000
40.000
45.000

MACH

PARAMETRIC VALUES
10.400 RM/L

1.160

	REFERENCE IN	TION
SREF	594.1360	SC.FT.
LREF	330.	IN.
BREF	330.	IN.
XMRP	1406.	IN.XT
YMRP	.	IN.YT
ZMRP	.	IN.ZT
SCALE	.	

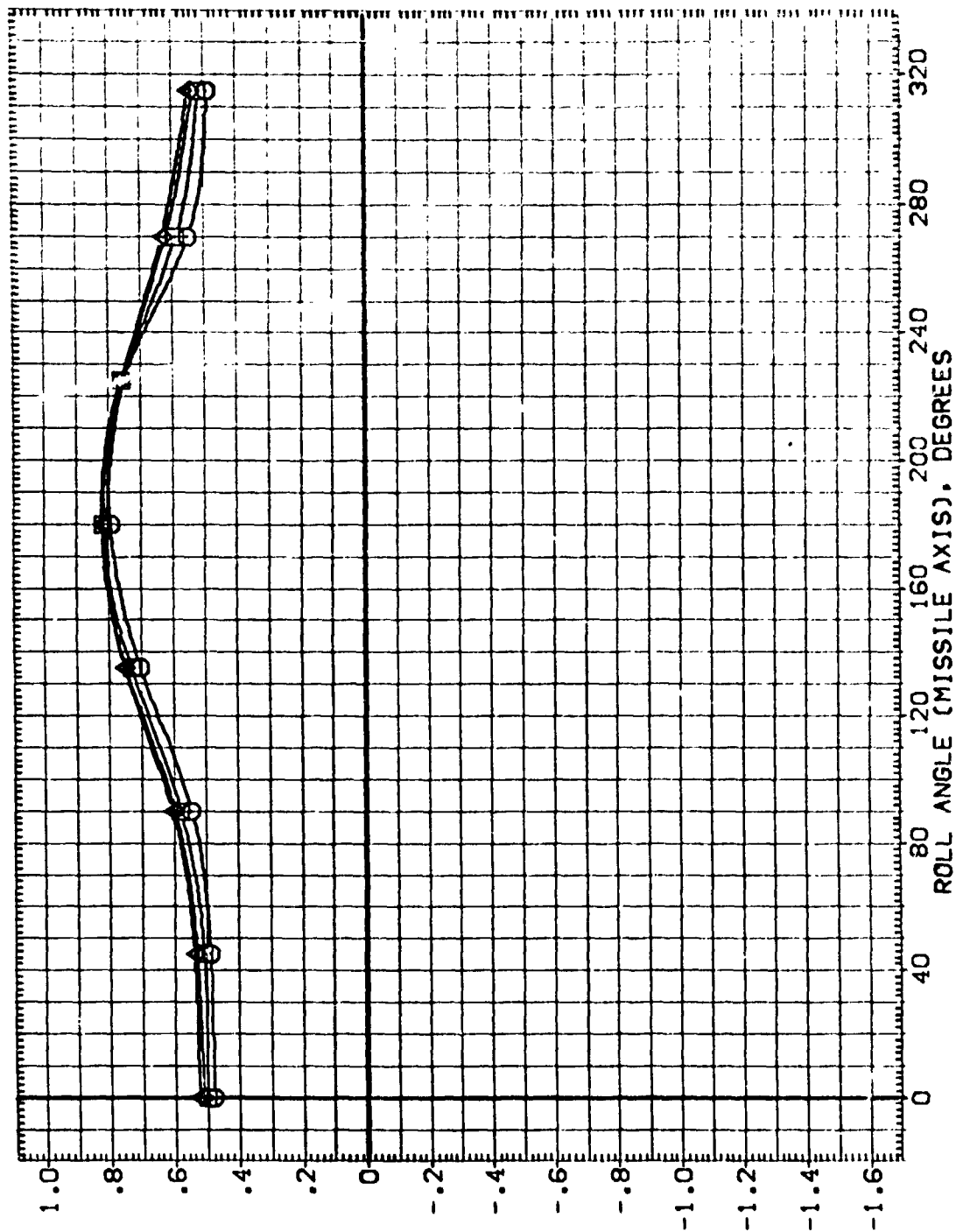


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

TION
 50.FT.
 N.
 N.XT
 N.YT
 N.ZT

ACE INF
 .1
 F
 LREF
 XMRP 1406
 ZMRP
 SCALE

PARAMETRIC VAL
 10.400 R/V/L 1.160

50:
 55:
 60:
 70:

◇
 □
 △

AXIAL FORCE COEFFICIENT (MISSILE AXIS), CA

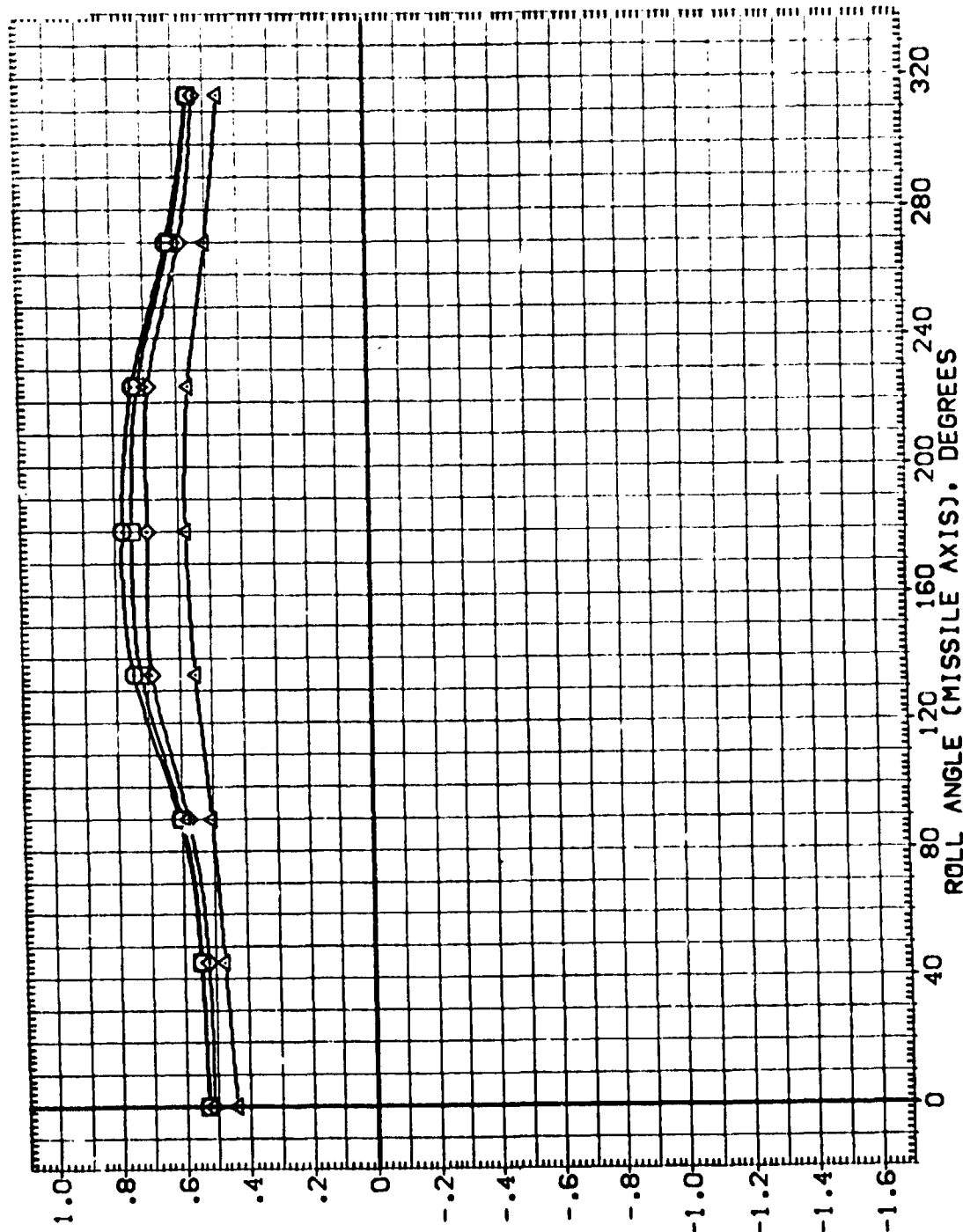


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA 75. 80.000 85.000 90.000
 PARAMETRIC VALUES 10.400 RN/L 1.160
 REFERENCE INF 594.1360 330. 330. 1406. : :
 SREF LREF BREF XMRP YMRP ZMRP SCALE : :
 TION 50.FT. IN. IN. XT IN. YT IN. ZT

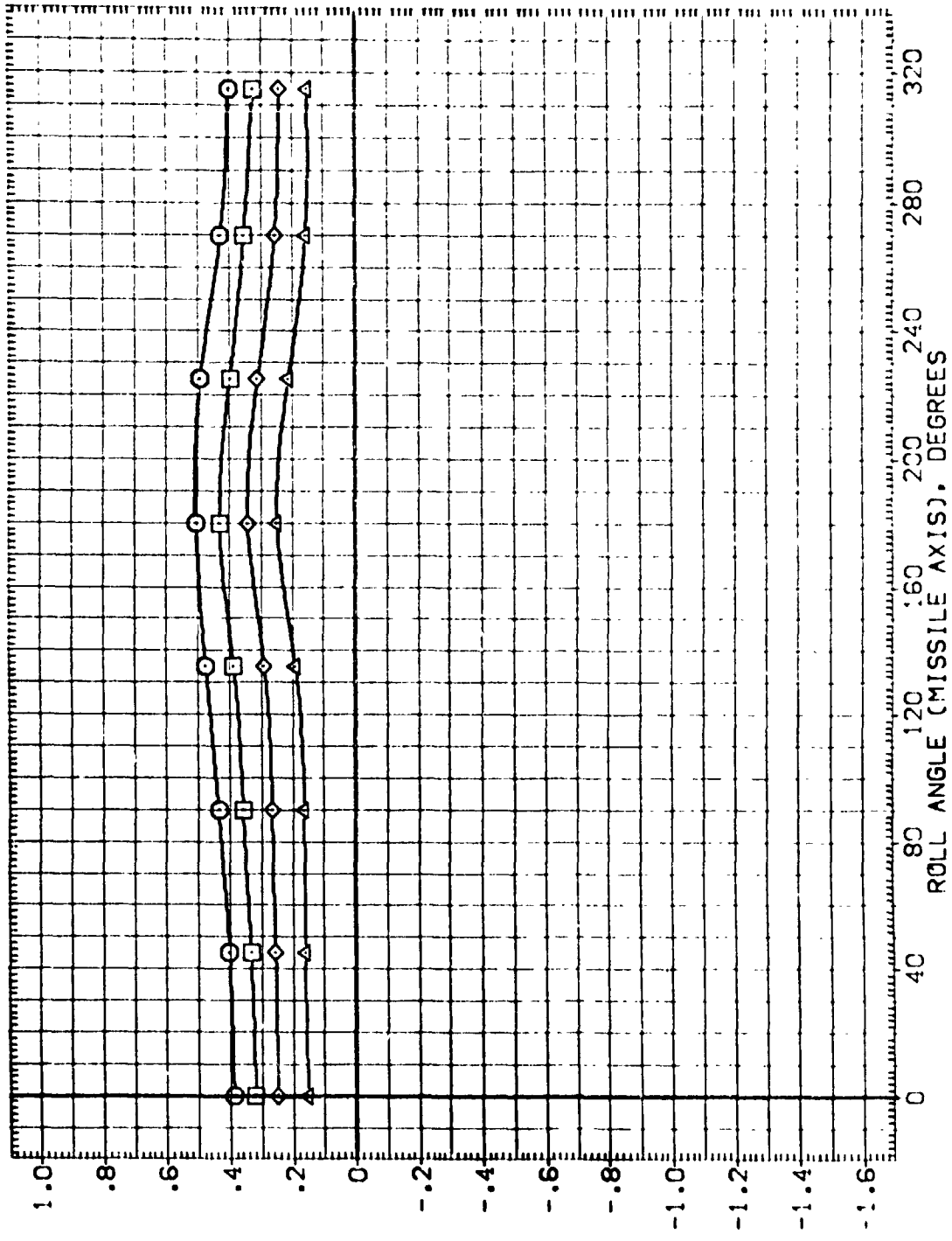


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(NYMOI)

ALPHA	PARAMETRIC VALUES	REFERENCE IIF	STATION
95.	10.400 RV/L	594.136C	50.FT.
100.000		330.	IN.
105.000		330.	IN.
110.000		1406.	IN.YT
		.	IN.YT
		.	IN.YT
		.	IN.ZT
		SCALE	

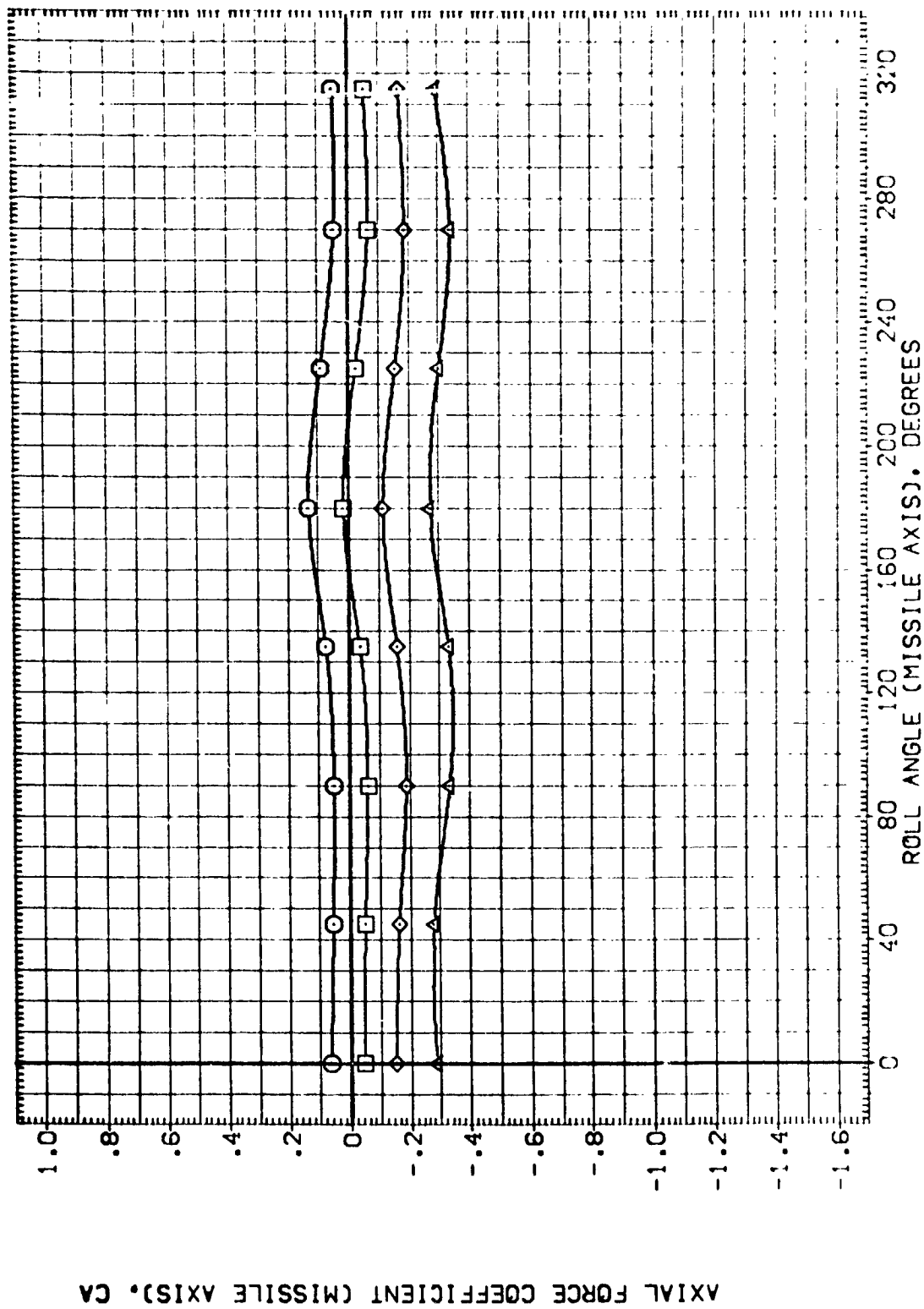


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA
115.000
120.000
125.000
130.000

PARAMETRIC VALUES
10.400 RN/L 1.160

REFERENCE INF
SREF 594.1360
LREF 330.
BREF 330.2000
XMRP 1406.
YMRP :
ZMRP :
SCALE :

TION
SQ.FT.
IN.
IN.
IN.
IN.
IN.

AXIAL FORCE COEFFICIENT (MISSILE AXIS), CA

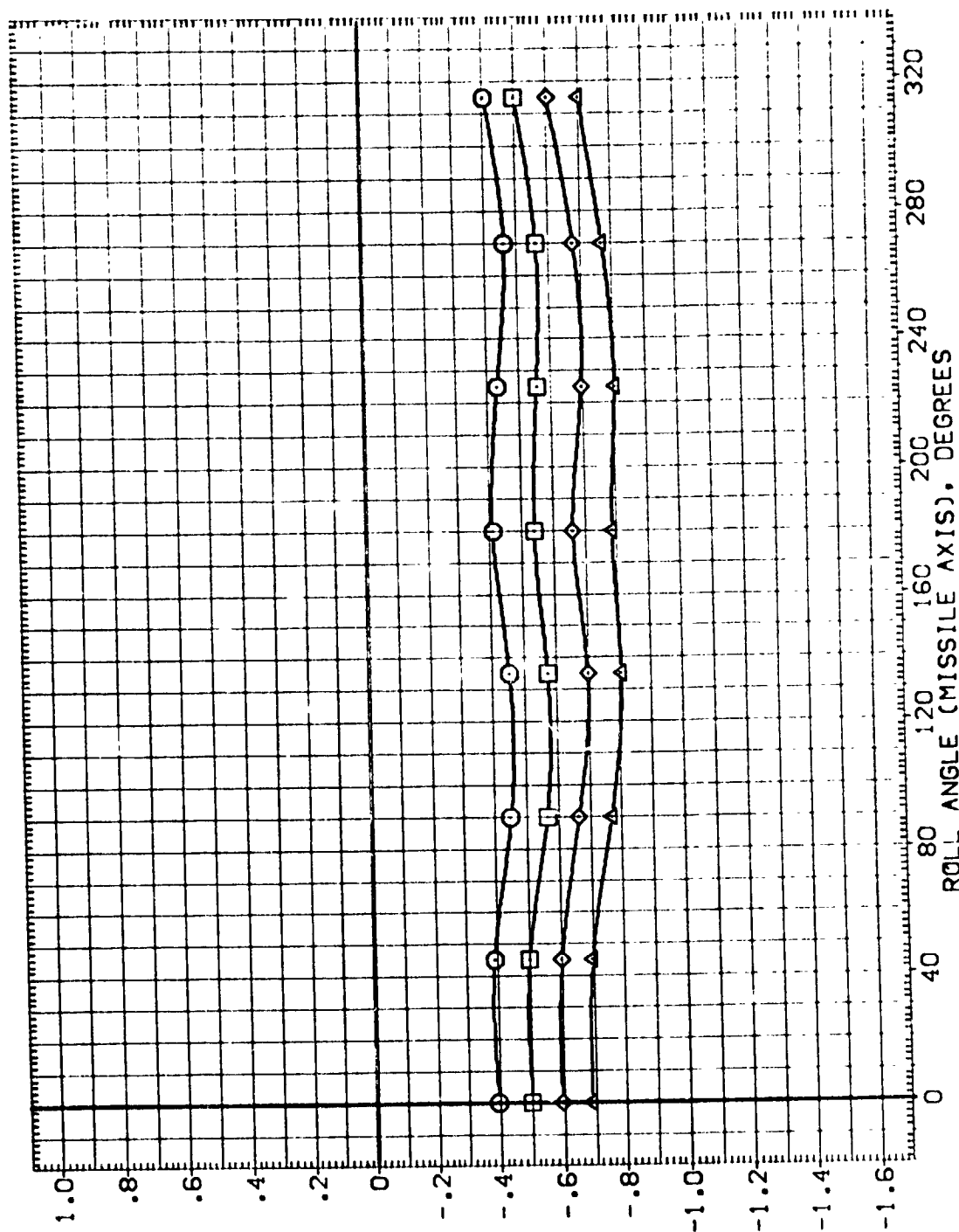


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	PARAMETRIC VALUES	REFERENCE INF	TION
135.000	HACH	SREF	594.1360
140.000	0.000	LREF	330.2000
145.000	RN/L	BREF	330.2000
150.000	1.160	XREF	1406.0000
		YREF	.0000
		ZREF	.0000
		SCALE	.0060

○ □ ◇ △

AXIAL FORCE COEFFICIENT (MISSILE AXIS), CA

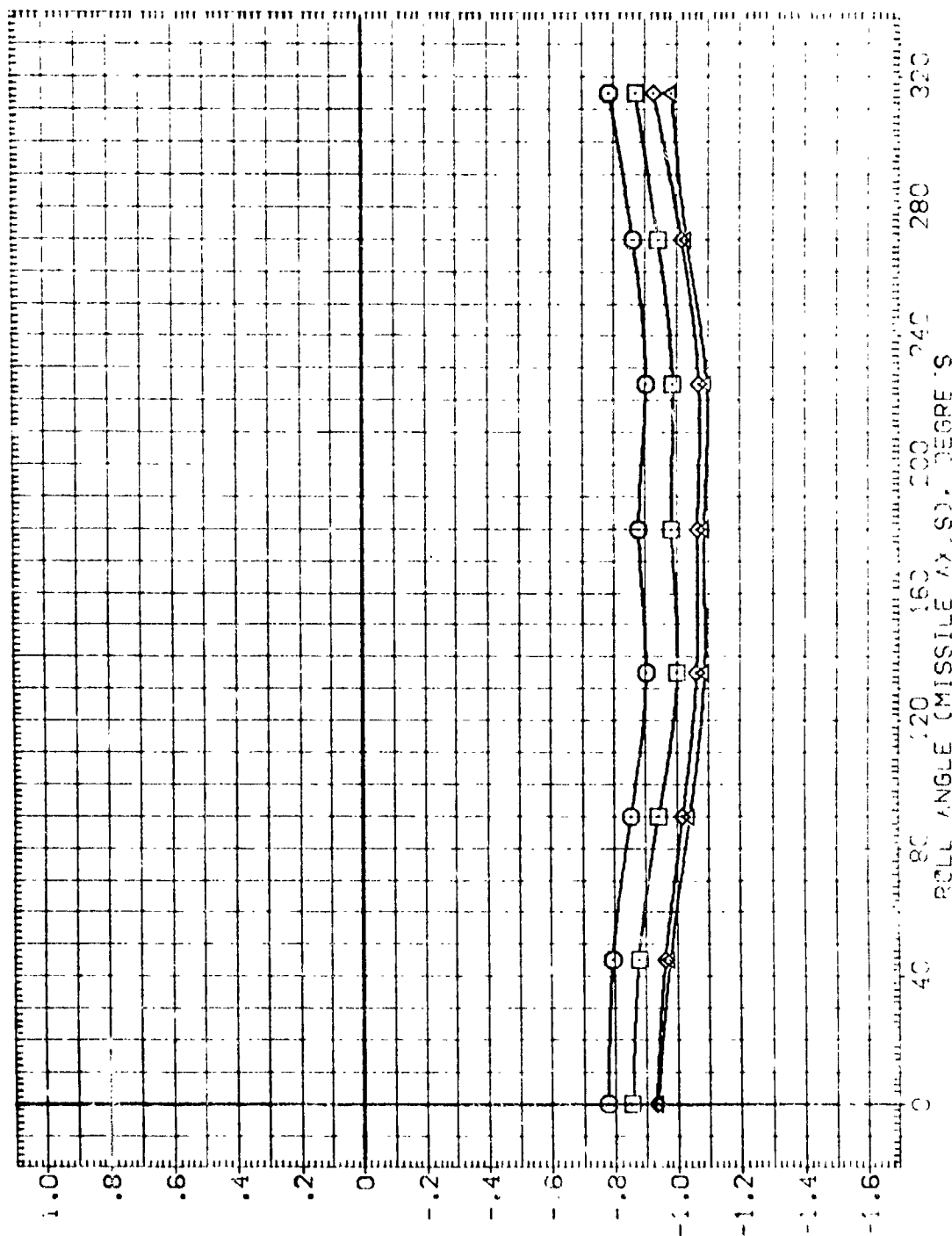


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	PARAMETRIC VALUES	REFERENCE INF	TION
159.	10.400 RN/L	594.1	50.FT.
160.000	1.160	330.	IN.
165.000		330.	IN.
170.000		1408.	IN.XT
			IN.YT
			IN.ZT
			SCALE

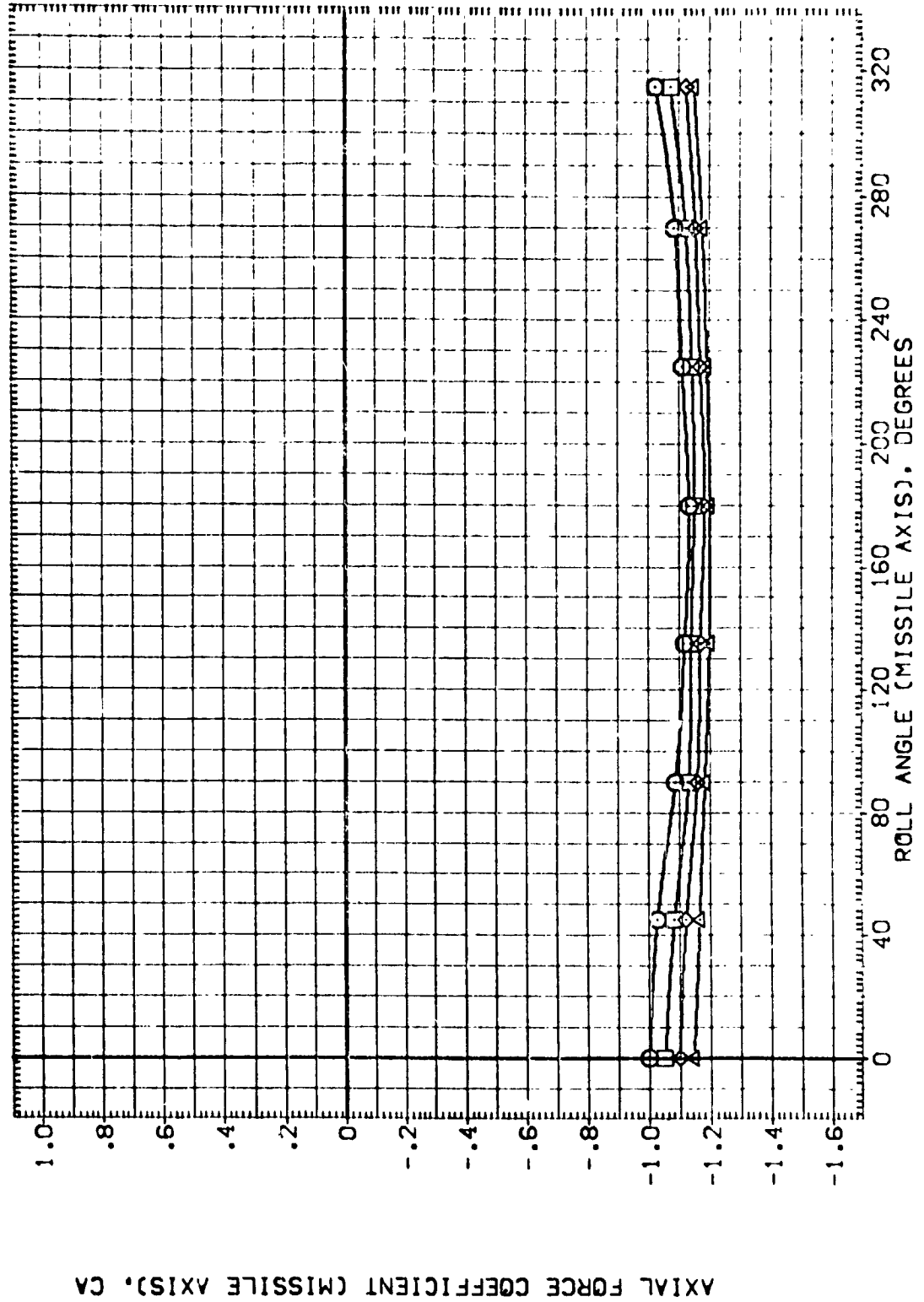


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ALPHA	PARAMETRIC VALUES	REFERENCE INF	TION
175.000	MACH	SREF	50.FT.
180.000	10.100	LREF	330.
185.000	RN/L	BREF	330.
	1.160	XMRP	1406.
		YMRP	...
		ZMRP	...
		SCALE	...

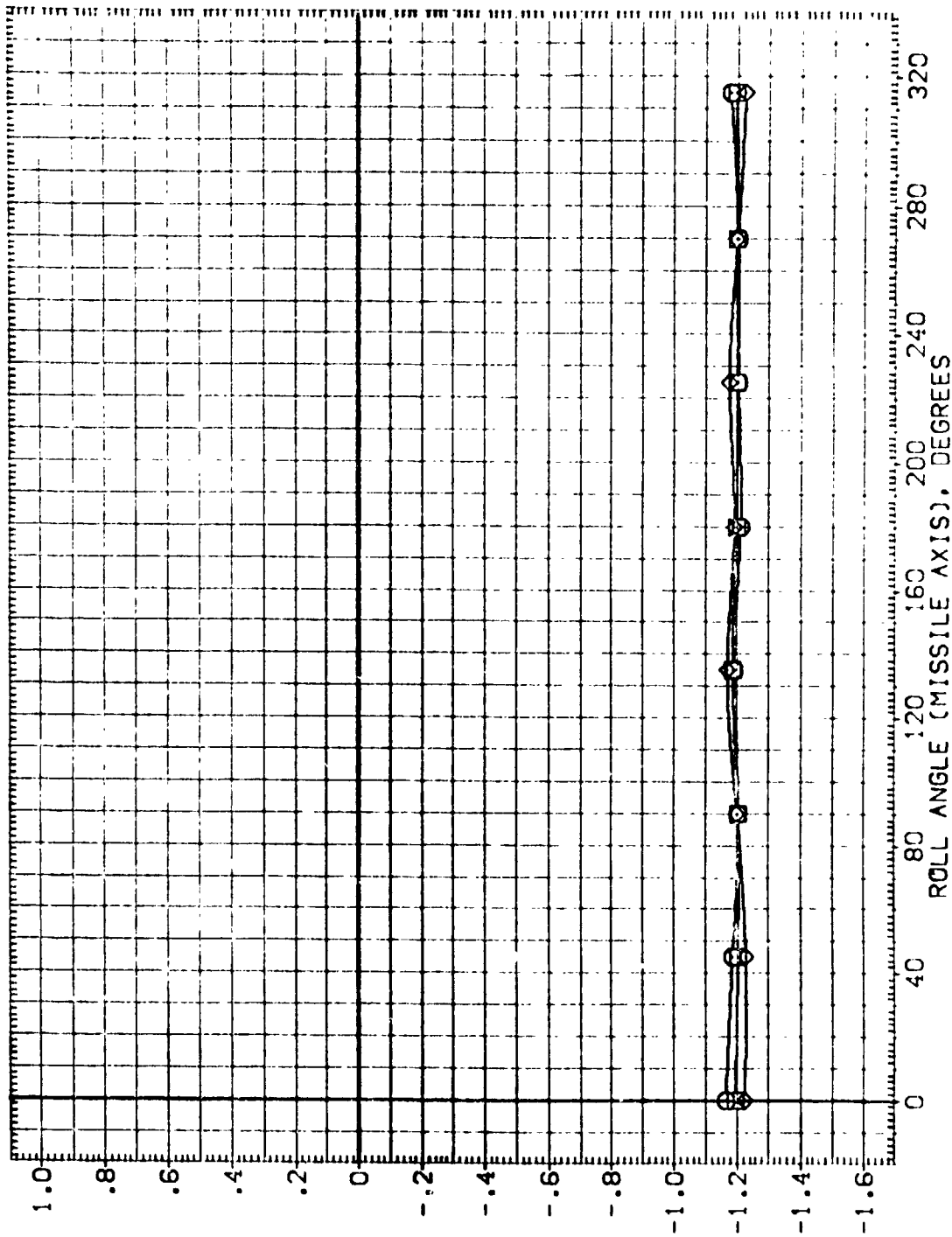


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF E1 (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA 15.000 20.000 25.000 30.000
 REFERENCE INF 594.1350 330. 330. 1406. : :
 SREF LREF BREF XMRP YMRP ZMRP SCALE : :
 TION 50 FT. IN. IN. XT IN. YT IN. ZT

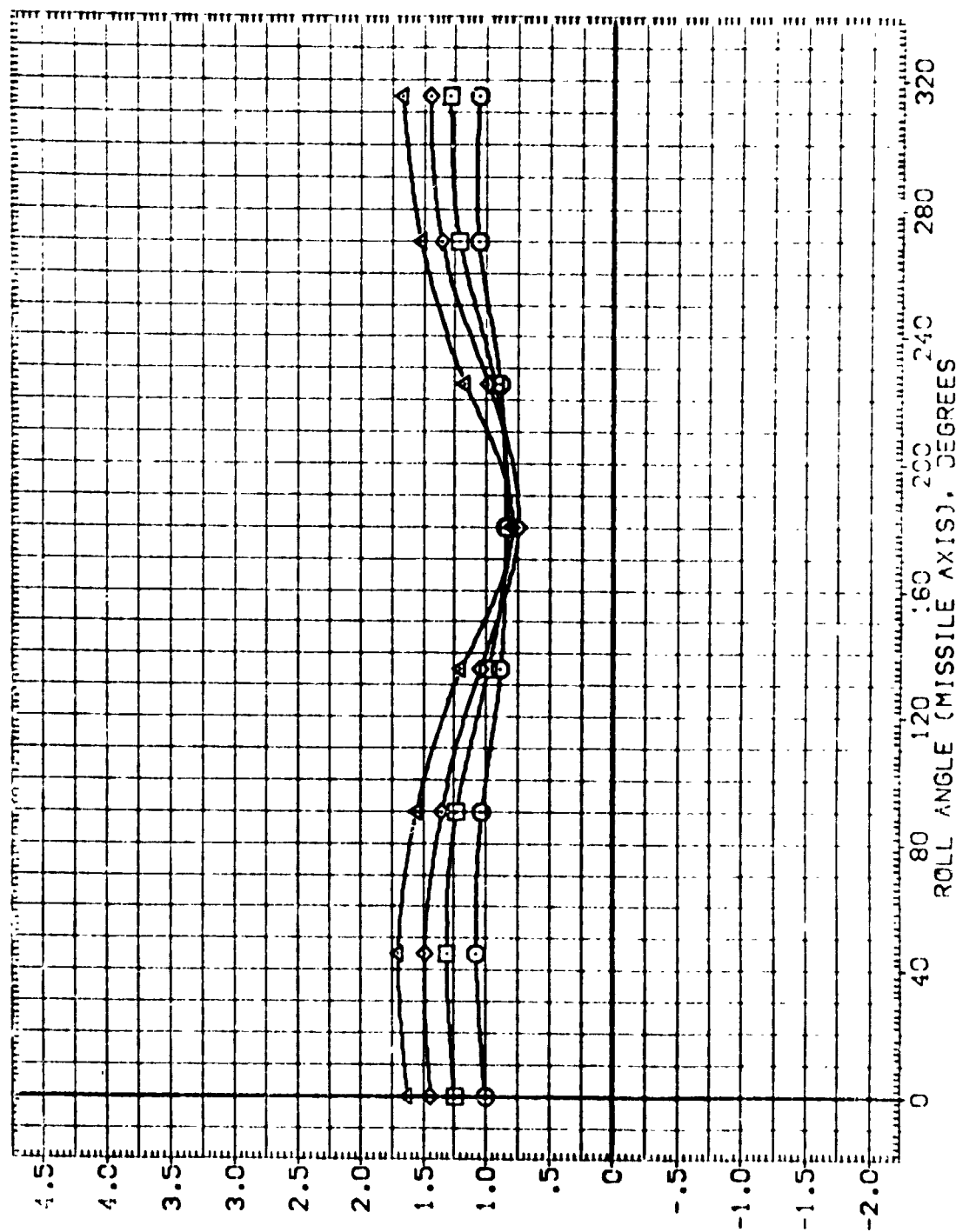


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(NE YMOI)

	REFERENCE IN'	TI ON
LREF	594.1360	SO.FT.
BREF	330.	IN.
X-REF	330.	IN.
Y-REF	1405.	IN.XT
	.	IN.YT
	.	IN.ZT
SCALE	.	

ALPHA	MACH	PARAMETRIC VALUES
30.		10.400 RN/L
35.		
40.		
45.		1.180

0000

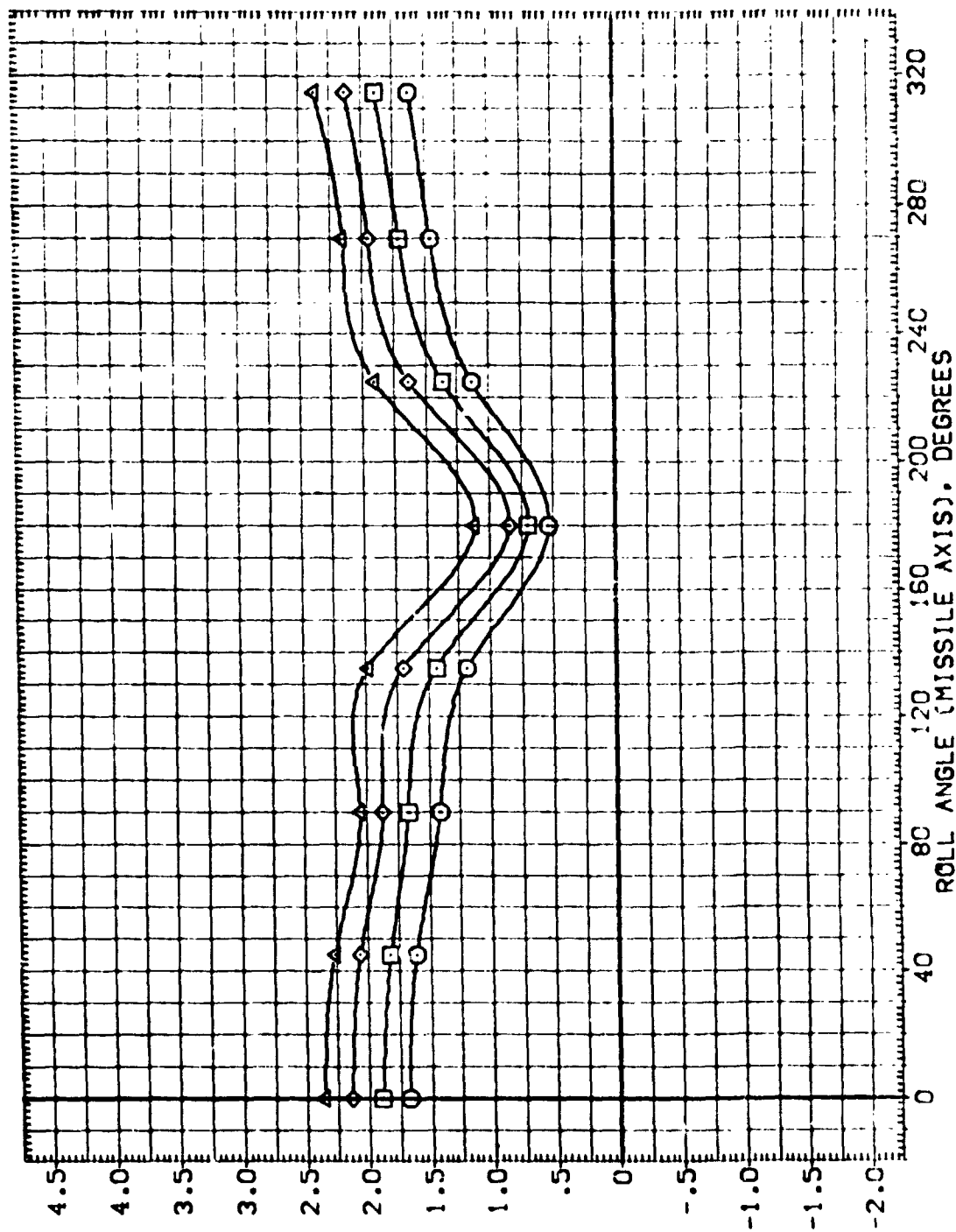
PITCHING MOMENT COEFFICIENT (MISSILE AXIS), CL_{PM}

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PRITUBERANCES) (NEYMOL)

INF **ACTION**

SQ.FY.

IN: X
IN: Y
IN: Y
IN: Y
IN: Z

LREF	594.1
BREF	330.
XHP	330.
	1406.

SCALE

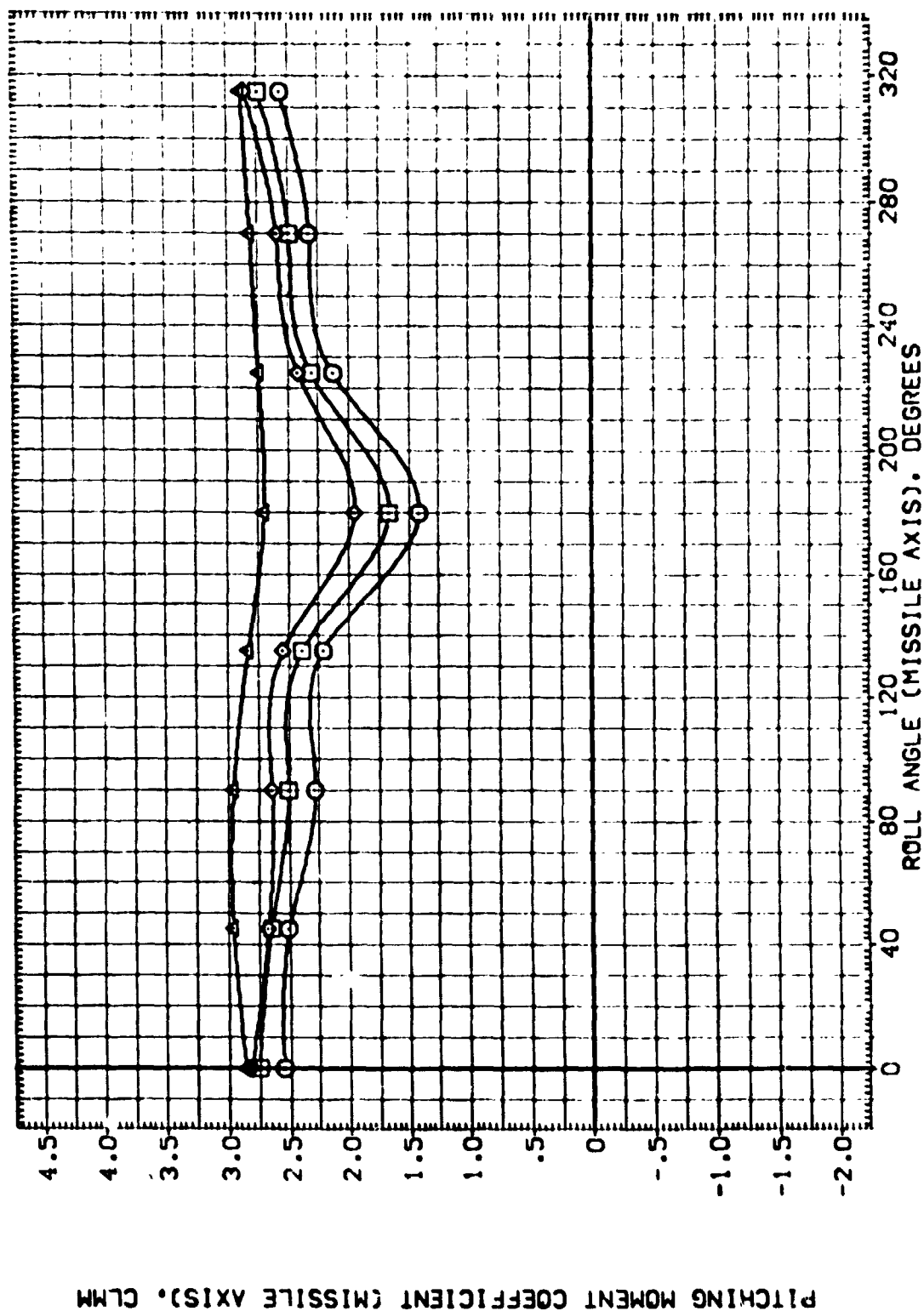


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES) (NEYM01)

75.
 80.
 85.00
 90.
 P. TRIC V 1.180
 REF 594.1360
 LREF 330.
 XREF 1406.
 YION 50.FT.
 IN.
 IN.
 IN.XY
 IN.YY
 IN.ZY

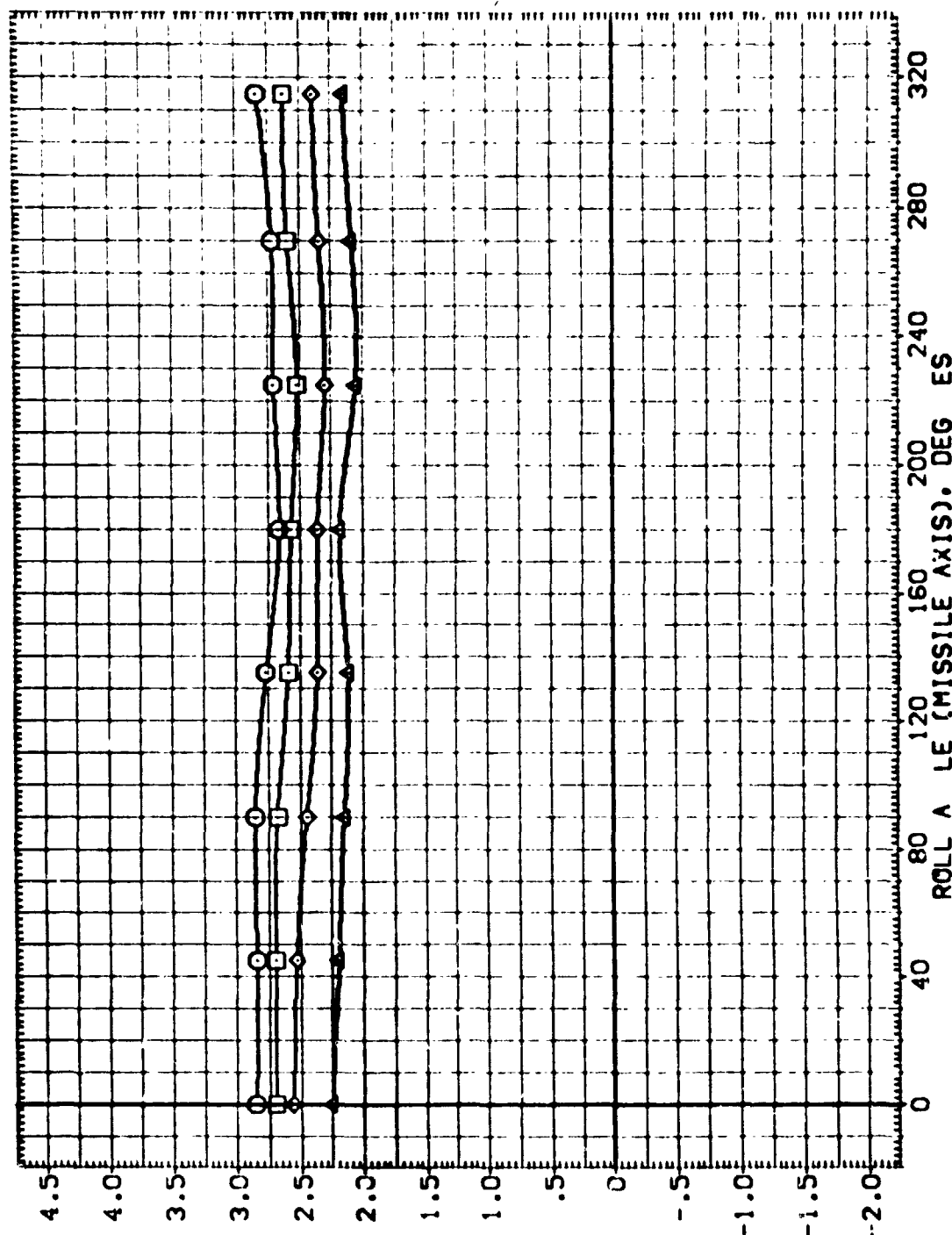


FIG. 9 COEFFICIENTS VERSUS ANGLE OF LL

(C I O M Y E N)

SREF	594.1	90.FT
LREF	330.	IN.
BREF	330.	IN.
XMRP	1406.	IN.XT
YMRP	.	IN.YT
ZMRP	.	IN.ZT
SCALE	.	

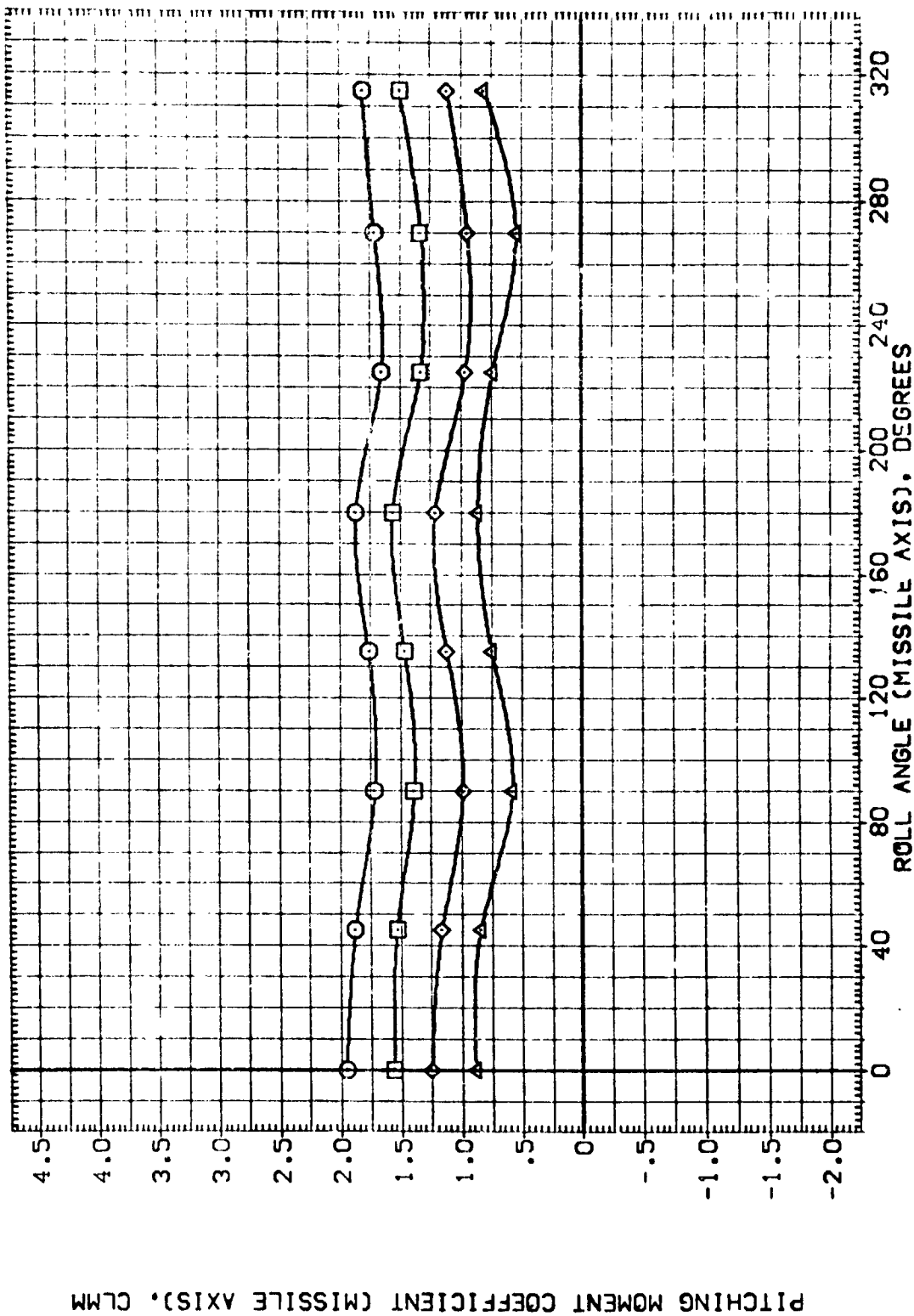


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	P	TRIC VALUES	REFERENCE INF	TION
115.000	MACH	10.400	594.1360	50.FT.
120.000		1.160	330.	IN.
125.000			330.	IN.
130.000			1406.	IN.XT
				IN.YT
				IN.ZT
				SCALE

○ □ ◇ △

PITCHING MOMENT COEFFICIENT (MISSILE AXIS), CLMM

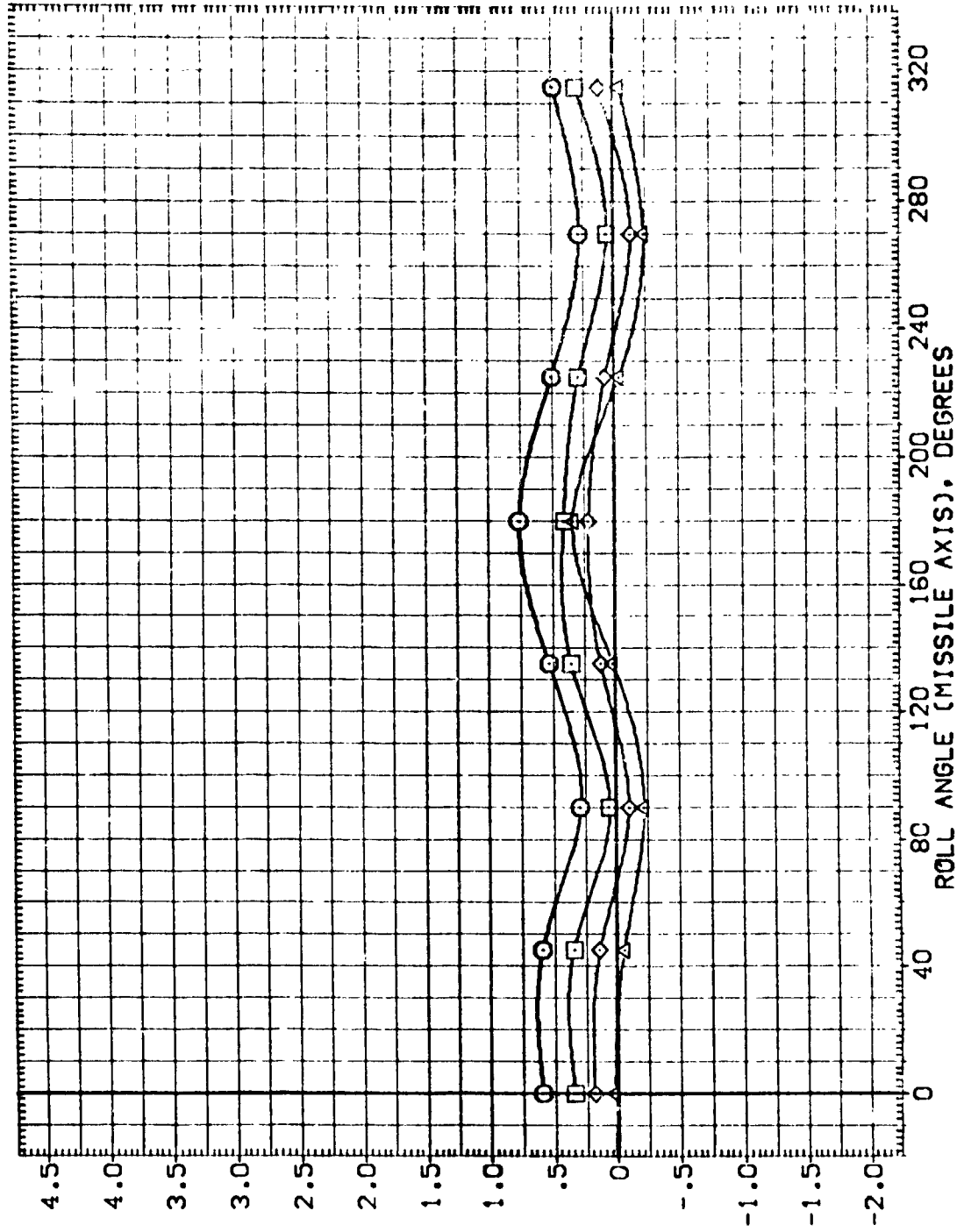


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(104Y3N)

SREF	594.1	INF	YION
LREF	330.		50.FT.
BREF	330.		IN.
XMRP	1406.		IN.
YMRP	.		IN.XT
ZMRP	.		IN.YT
SCALE	.		IN.ZT

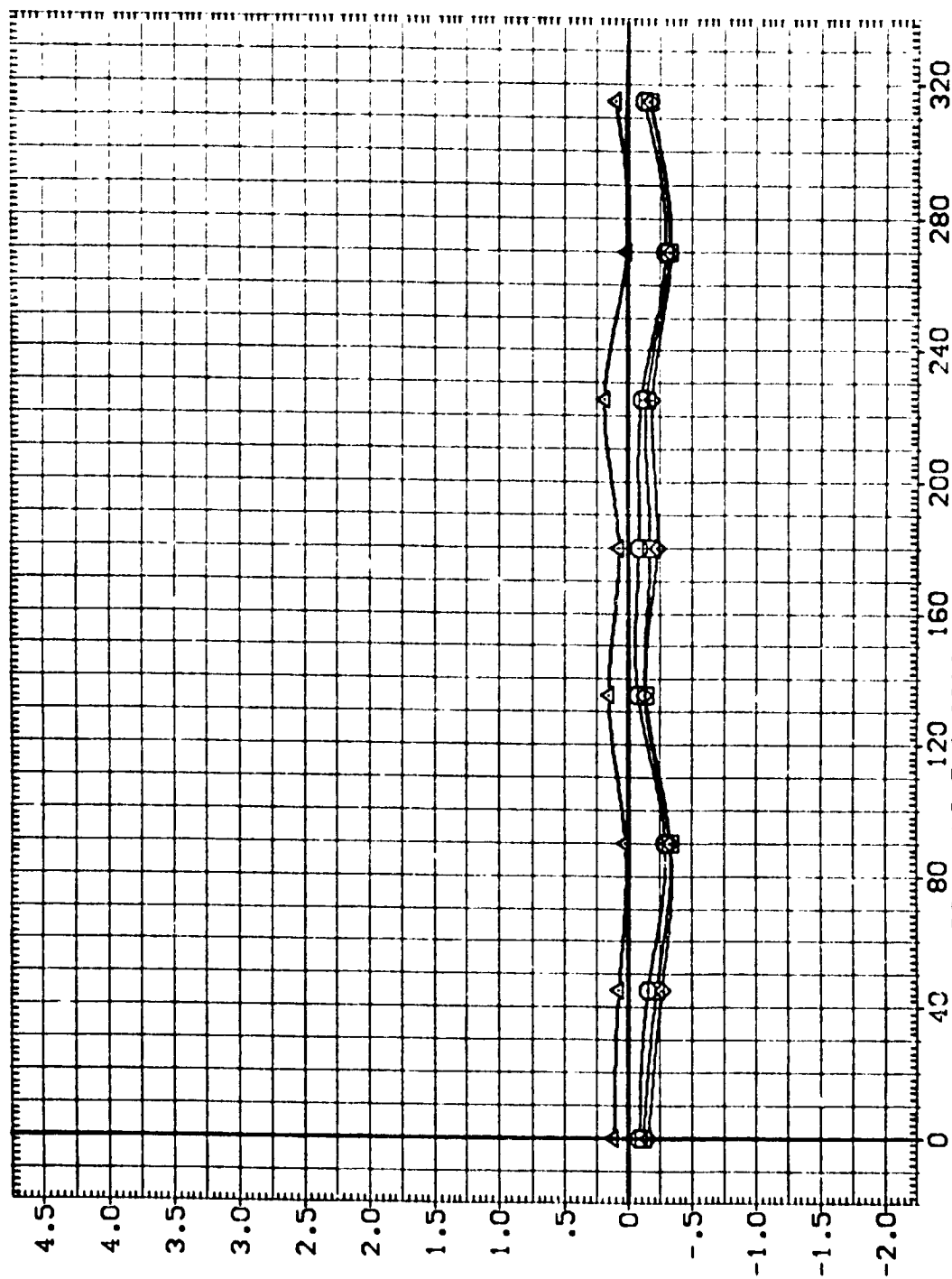
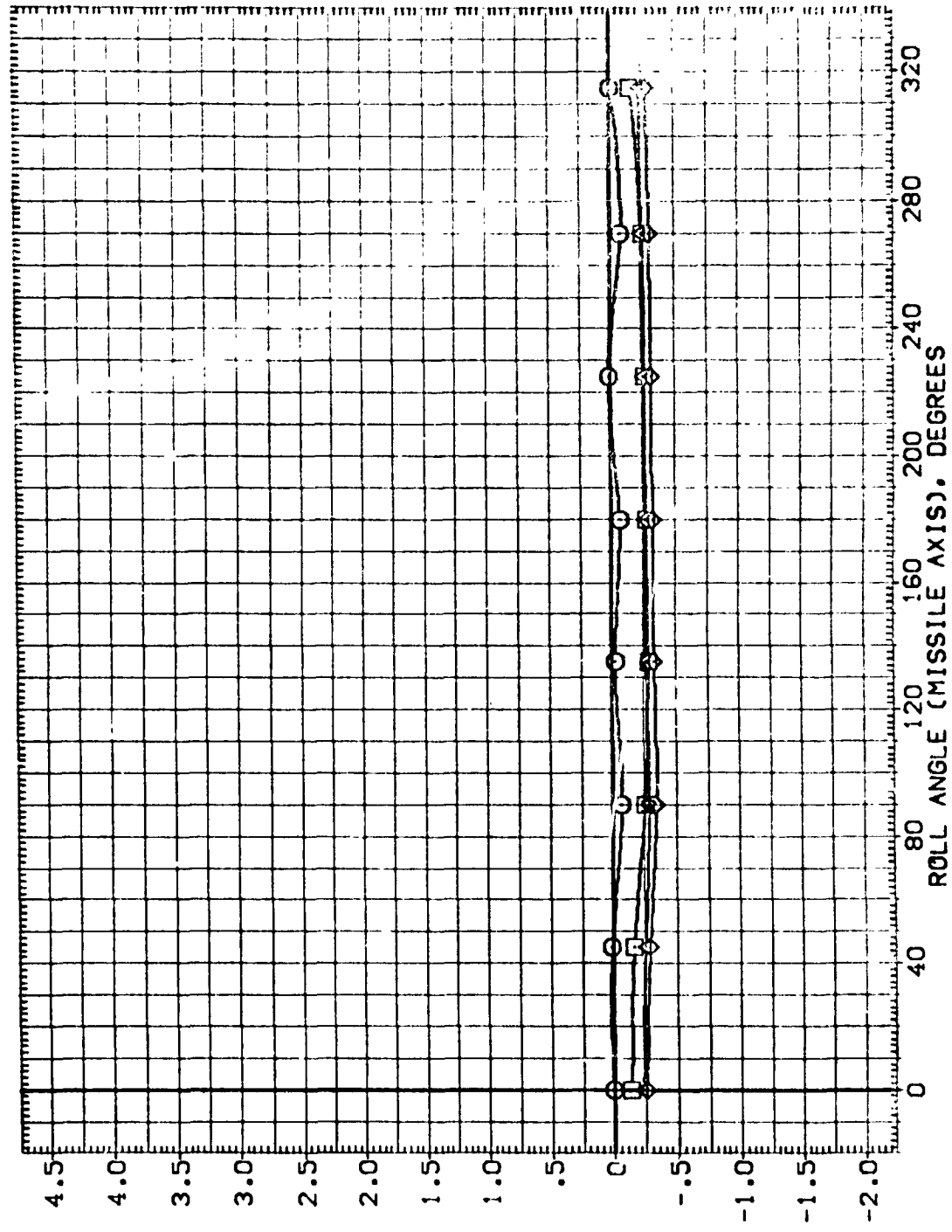


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	MACH	PARAMETRIC VALUES	REFERENCE INF	TION
155.		10.400 RVL	594.1360	50.FT.
160.000	1.160		330.	IN.
165.000			330.	IN.
170.000			1406.	IN.
			YMRP	IN.
			ZMRP	IN.
			SCALE	IN.



PITCHING MOMENT COEFFICIENT (MISSILE AXIS), CLM

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA 175.000
 180.000
 185.000
 P 10.400 RV/L 1.160
 REFERENCE INF
 SREF 594.1360
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP .0000
 ZMRP .0000
 SCALE .0060
 TION
 SQ.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

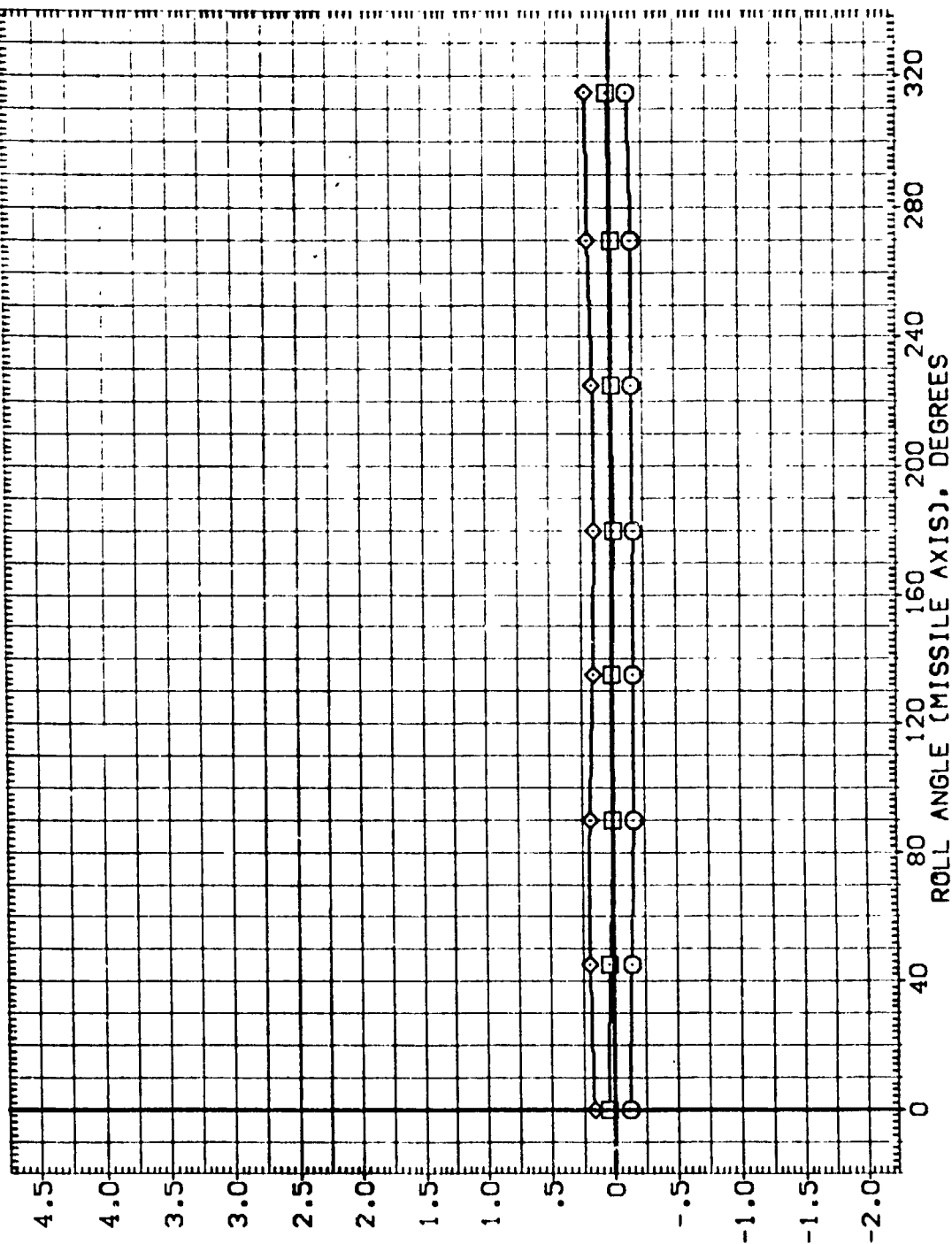


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

S

ALPHA
-5.
.000
5.000
10.000

MACH 10.400 RN/L 1.160

REFERENCE INFORMATION
SREF 594.1360 50.FT.
LREF 330. IN.
BREF 330. IN.
XMRP 1406. IN.XT
YMRP . IN.YT
ZMRP . IN.ZT
SCALE .

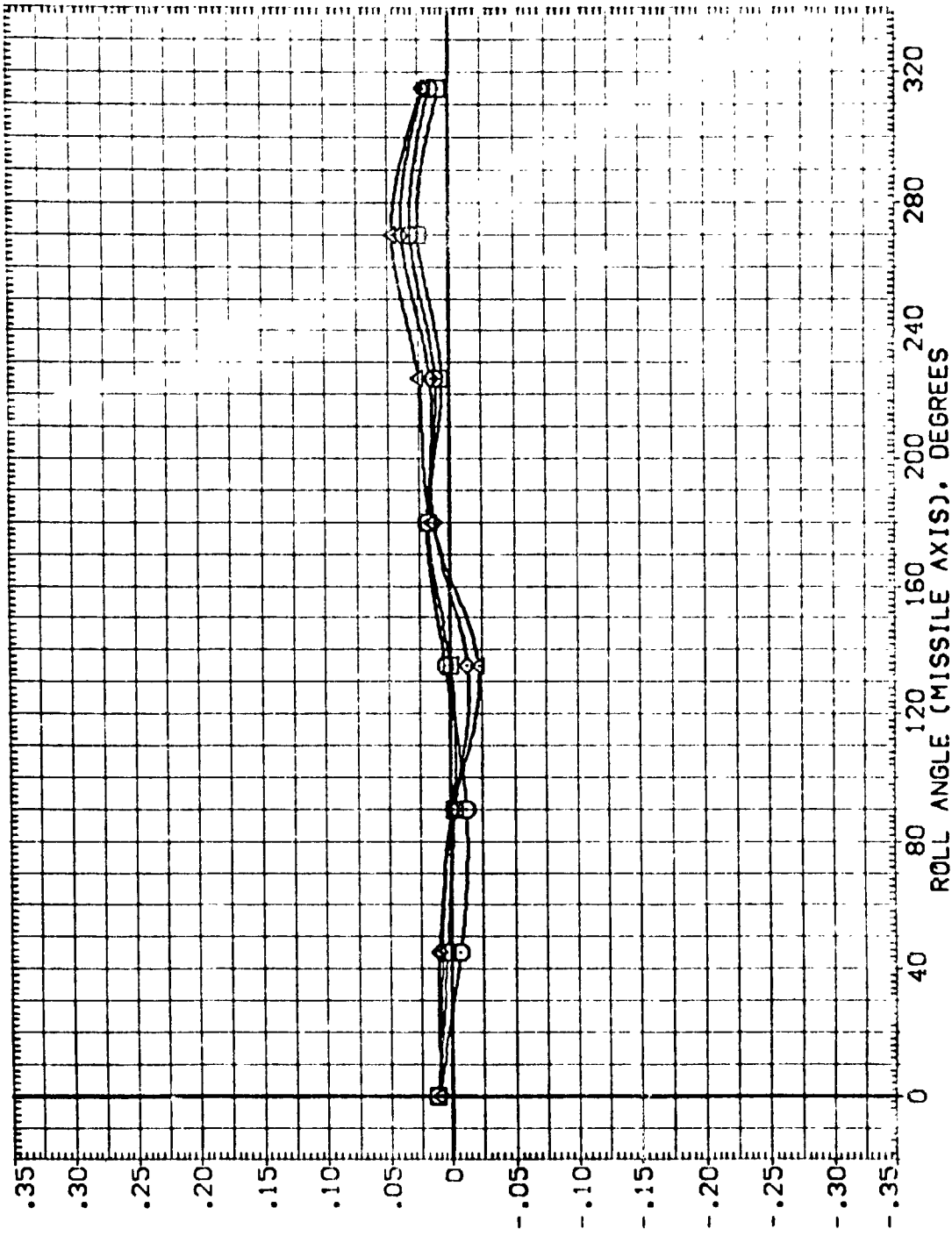


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

15. 30.000
 20. 30.000
 25. 30.000
 30. 30.000
 P 10.400 TRIC V S 1.160
 594.1 INF 50.FT.
 300. IN.
 1406. IN.XY
 . . . IN.YY
 . . . IN.ZT

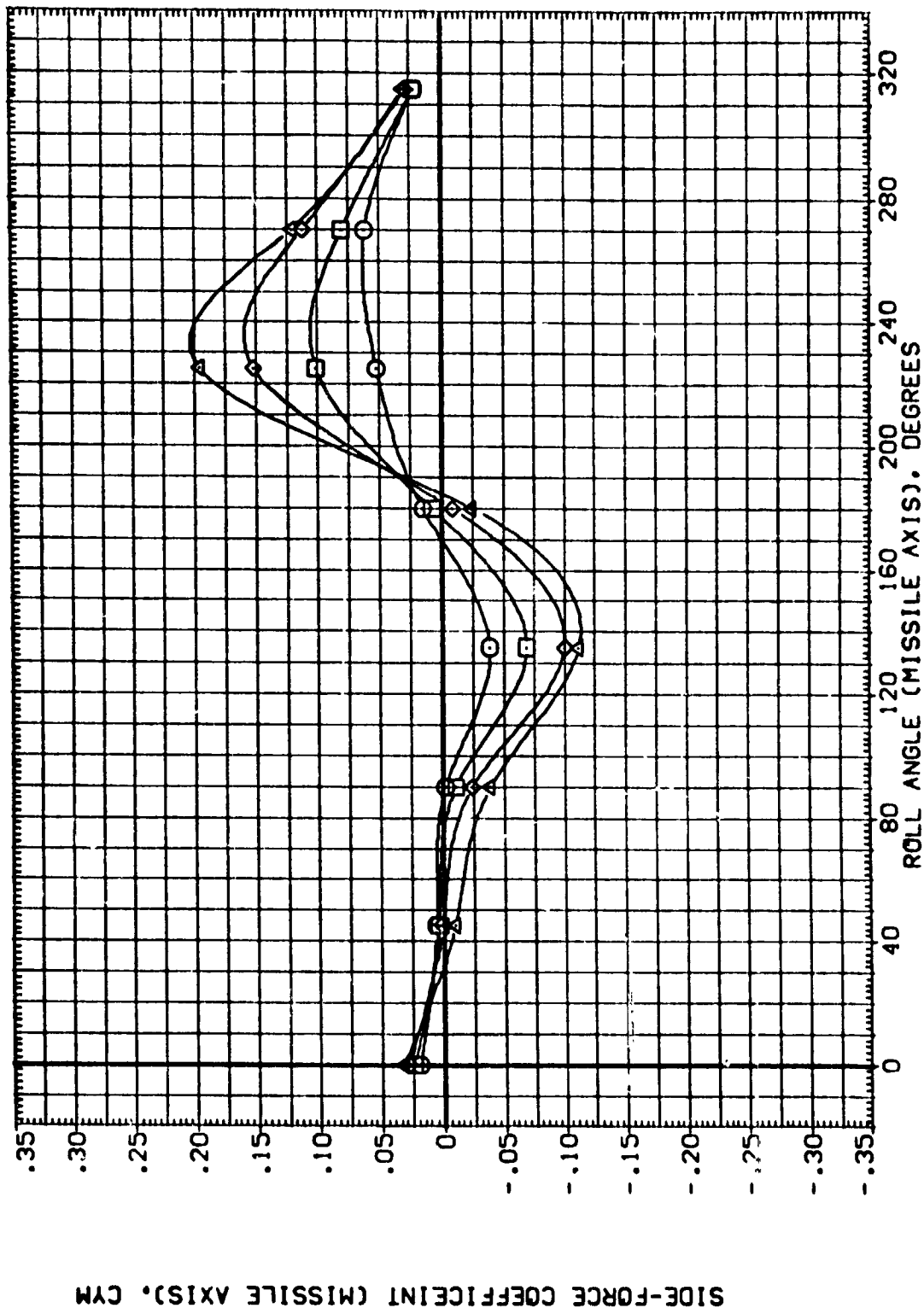


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA 30.000 35.000 40.000 45.000
 MACH 10.400 RN/L 1.160
 S O \square \diamond \triangle
 REFERENCE: SREF 594.1 LREF 330. BREF 330. XMRP 1406. YMRP .
 TION: SQ.FT. IN. IN. IN. XT IN. YT IN. ZT IN.

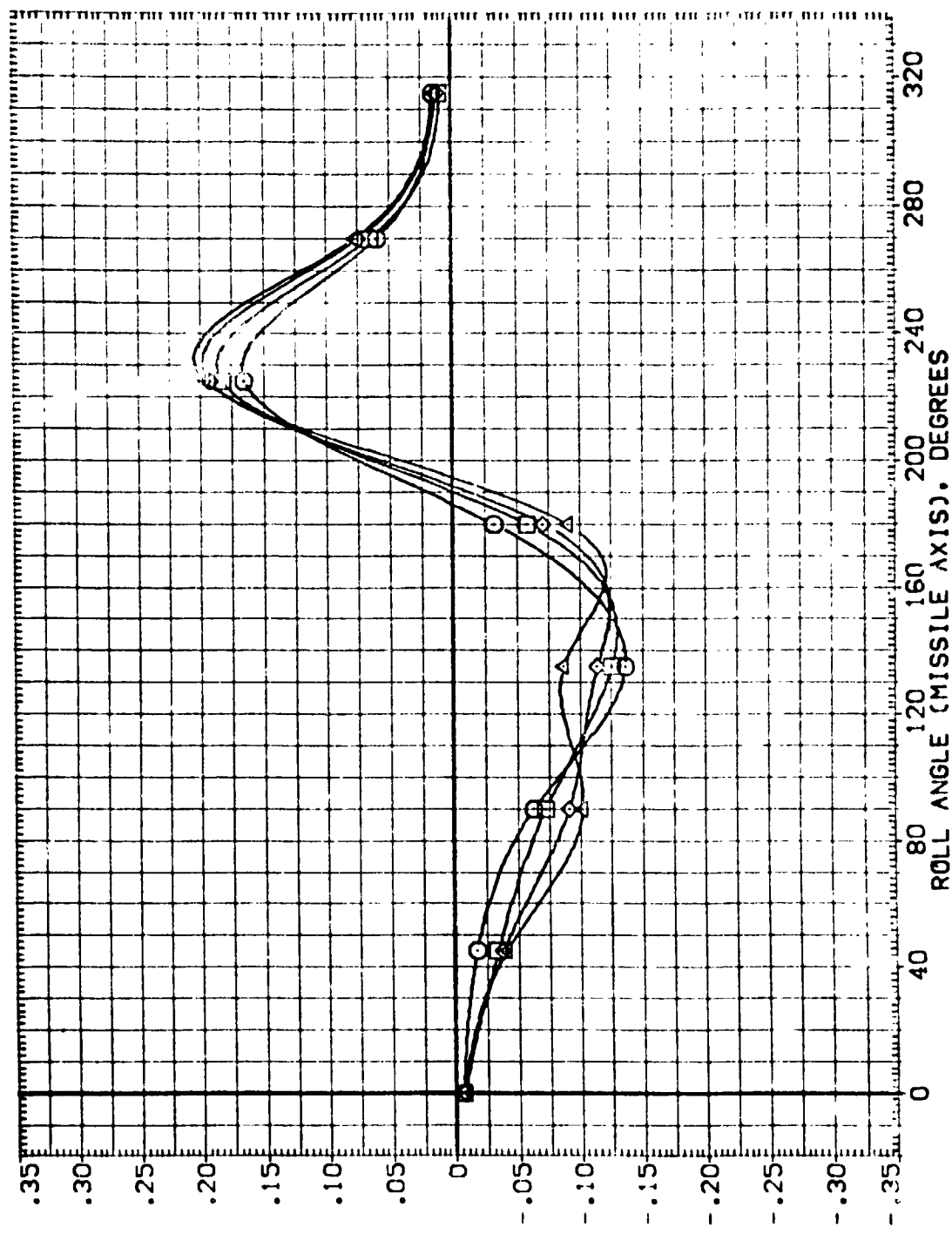


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA	PARAMETRIC VALUES	REFERENCE INF	TION
50.000	10.400 RV/L 1.160	SREF 594.1360	50.FT.
55.000		LREF 330.	IN.
60.000		BREF 330.	IN.XT
70.000		XREF 1406.	IN.YT
		YREF .	IN.ZT
		ZREF .	
		SCALE .	

△ □ ◇

SIDE-FORCE COEFFICIENT (MISSILE AXIS), C_{YM}

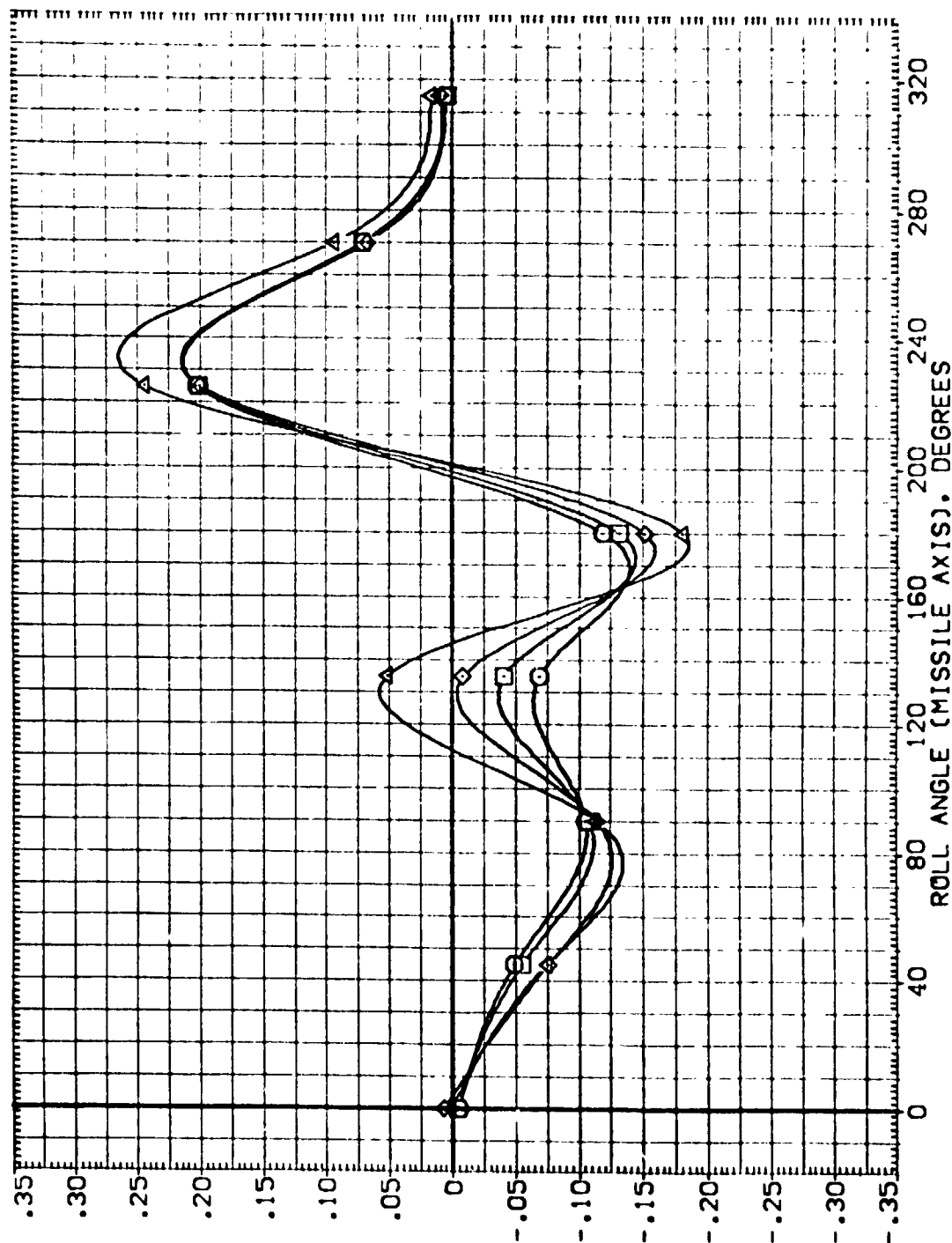


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

SREF	594.1
_REF	330.
BREF	330.
XMRP	1406.
YMRP	.
ZMRP	.
SCALE	.

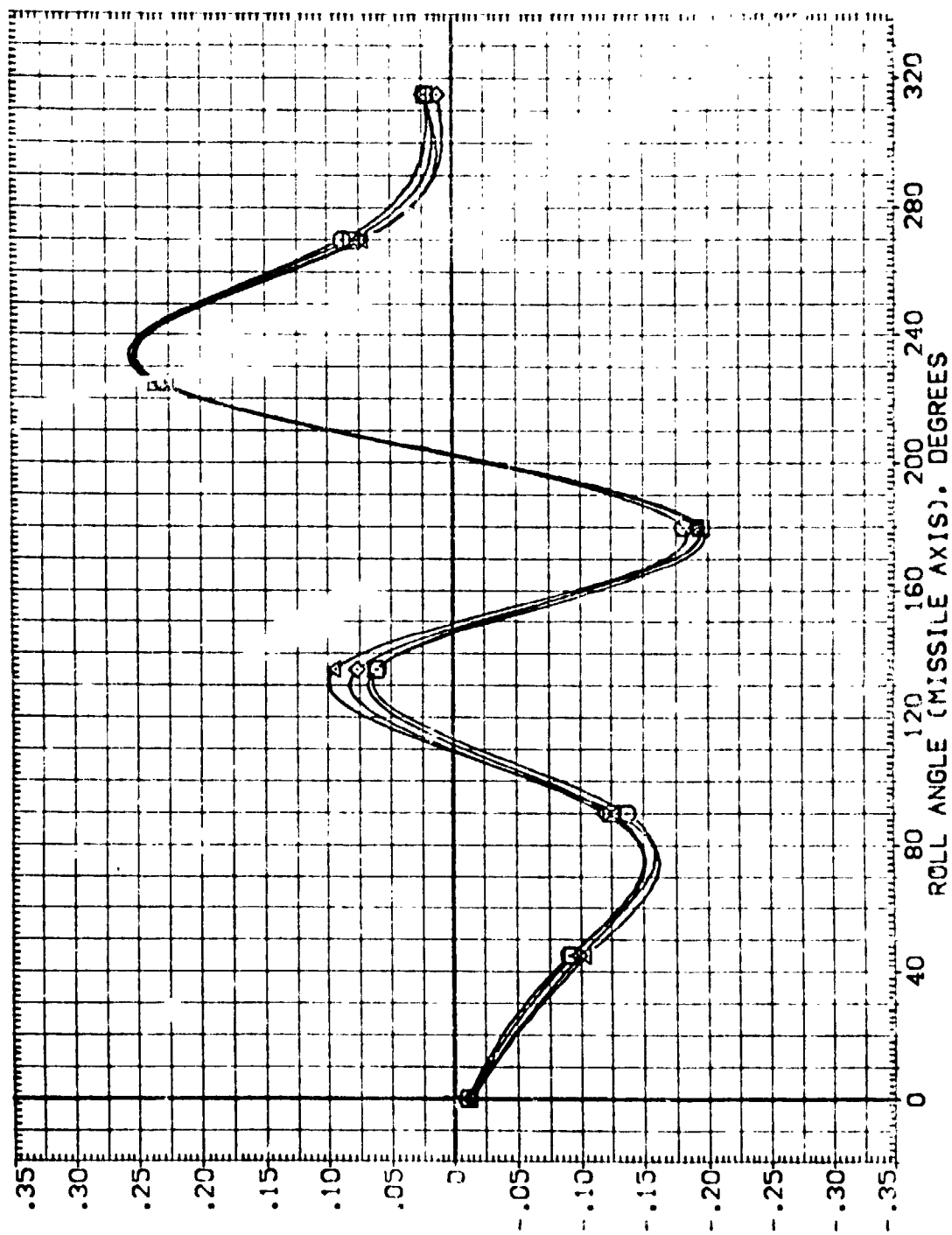


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMOI)

ALPHA	PA	TRIC VALUES	REFERENCE INFORMATION
95.	10.400	RA/L	SREF 594.1
100.			LREF 330.
105.			BREF 1406.
110.			IN. XT
			IN. YT
			IN. ZT

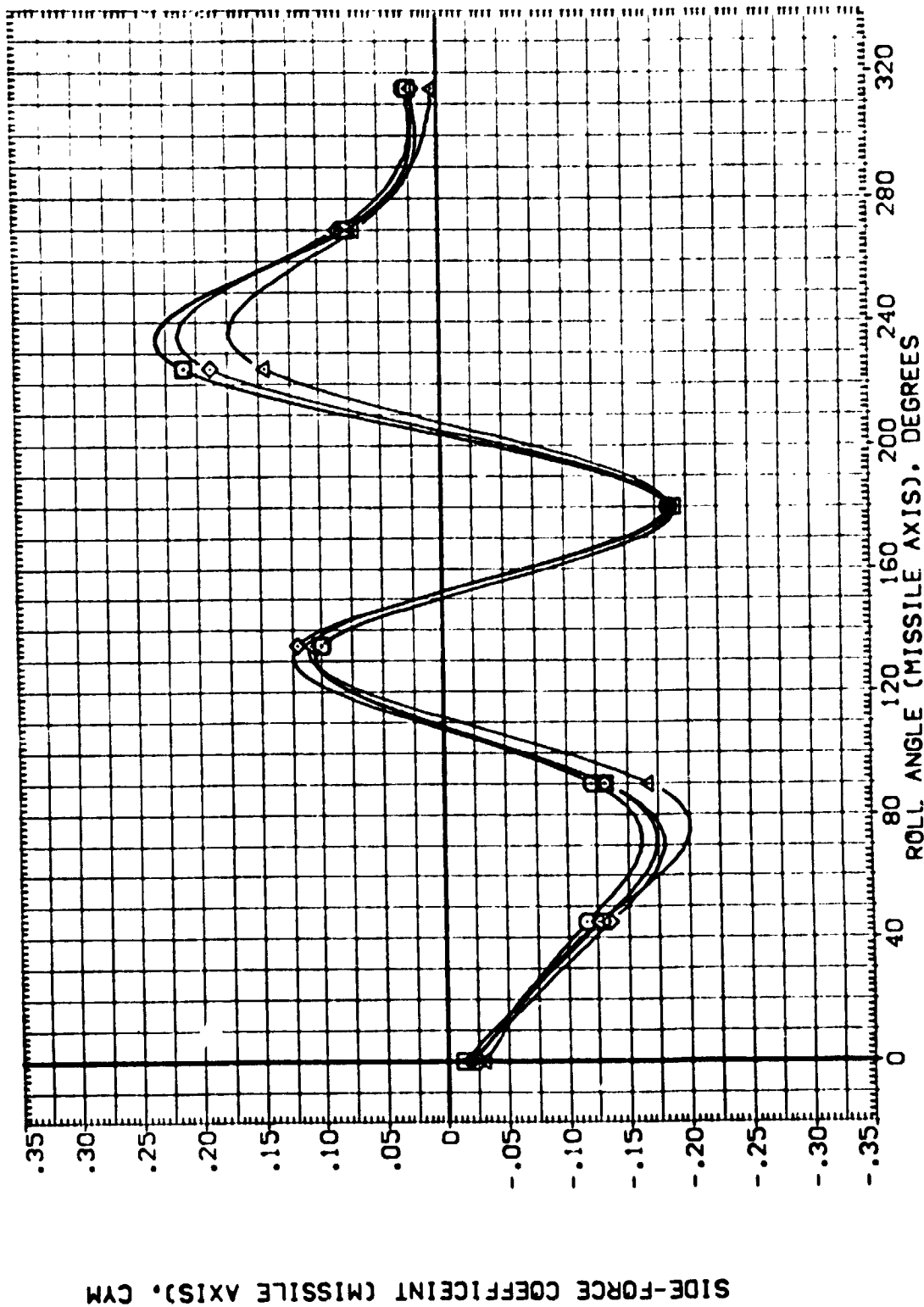


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ᠠᠨᠠᠨᠠᠨᠠᠨ
ᠣᠣᠣᠣᠣᠣ

ANETRIC V \$ 1.100

10N
 99.5Y.
 1N. 1Y
 1N. 1Y
 1N. 1Y
 1N. 1Y
 1N. 1Y

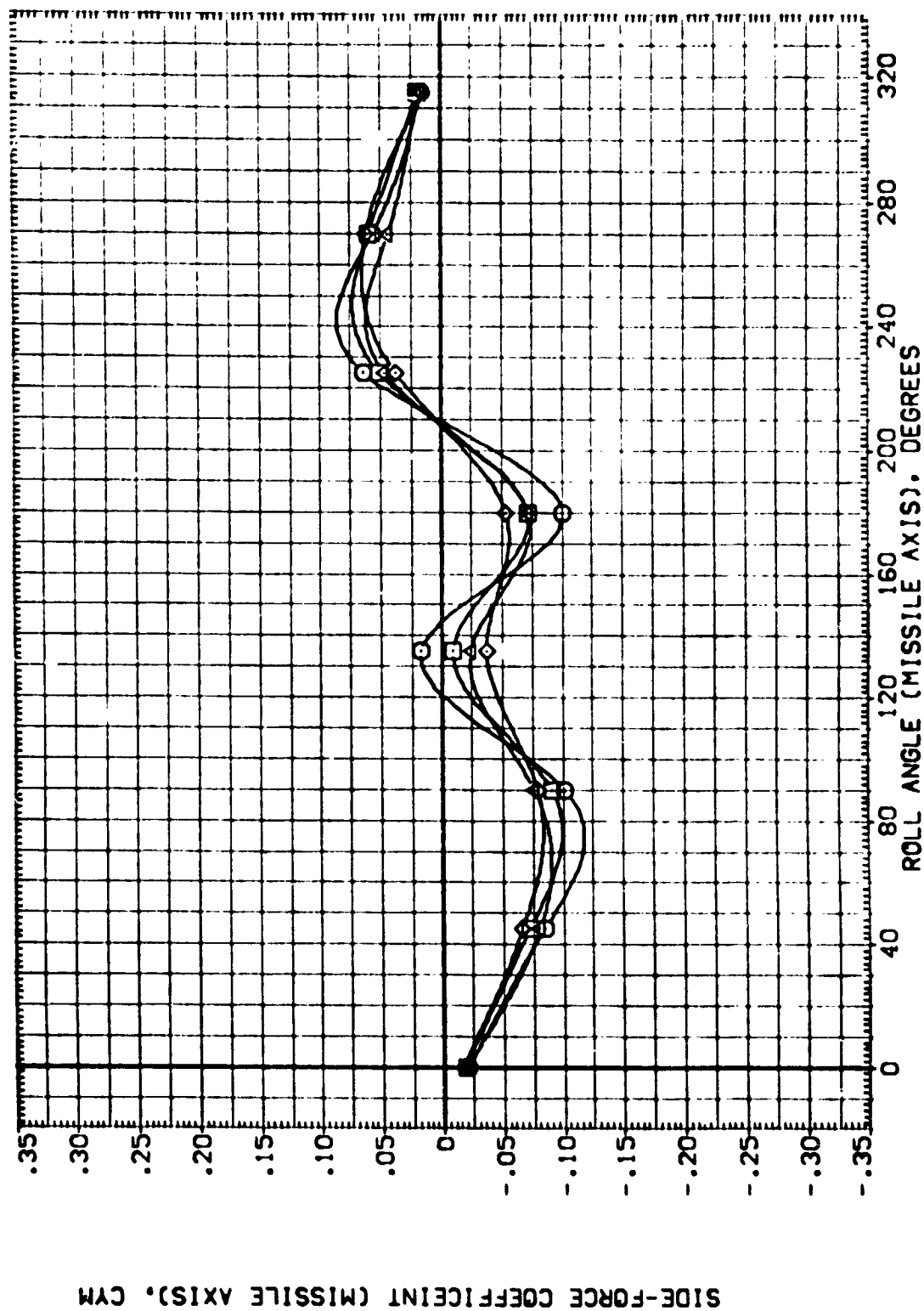


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH P TUBERANCES) (NEYMOI)

155.
 160.
 165.
 170.

PARAMETRIC V S 1.160
 10.400 RV/L

REF F 594.1
 LREF 330.
 F 330.
 XAPP 1406.
 YAPP :
 SCALE :

TION
 SO.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

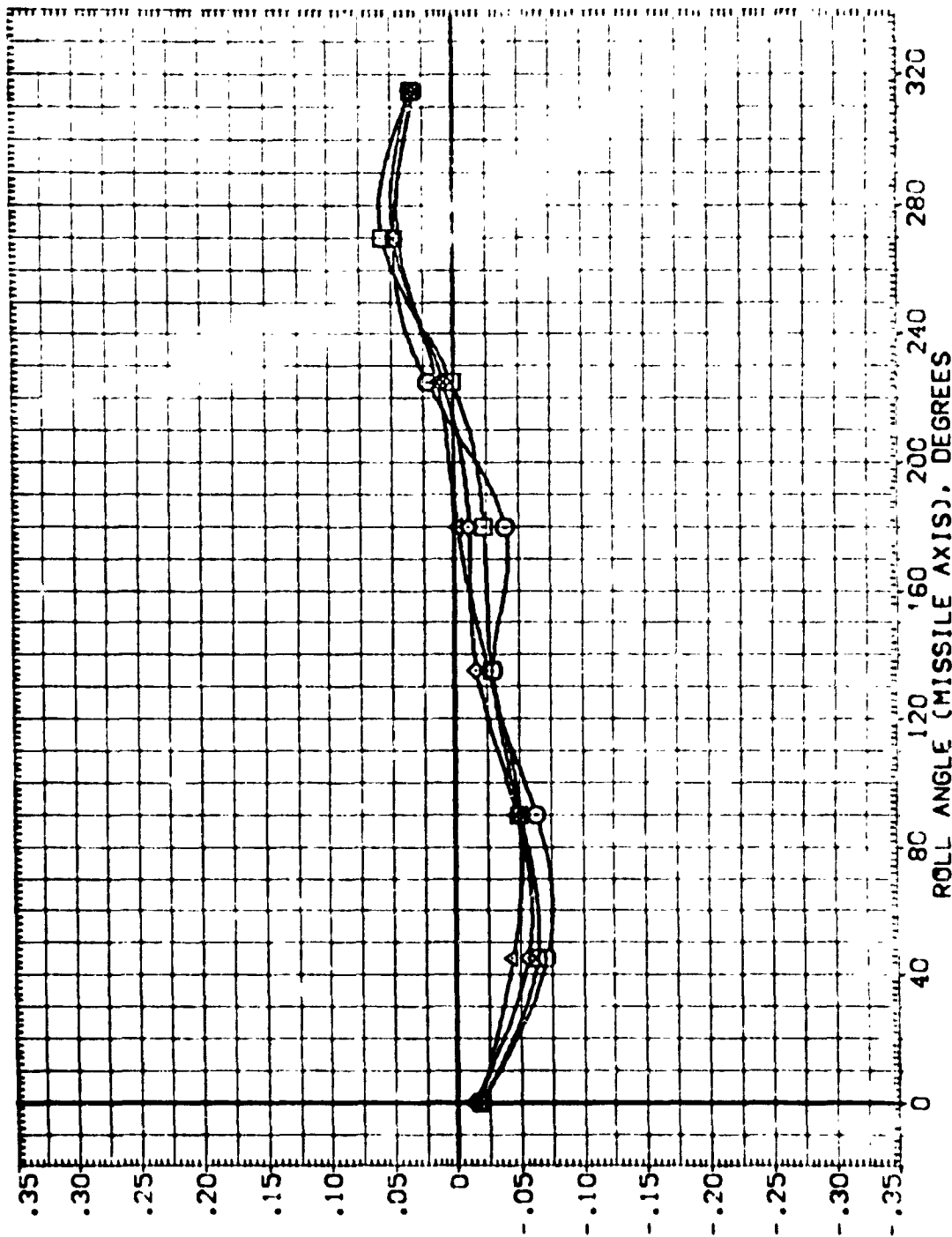


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMD1)

ALPMA 175. 180. 185.000
 P 10.400 RV/L 1.160
 TRIC VALUES
 SREF 594.360
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP .
 ZMRP .
 SCALE .
 TION 50.FT.
 IN.
 IN.
 IN.XI
 IN.YI
 IN.ZI

○ □ ◇

SIDE-FORCE COEFFICIENT (MISSILE AXIS), C_{YM}

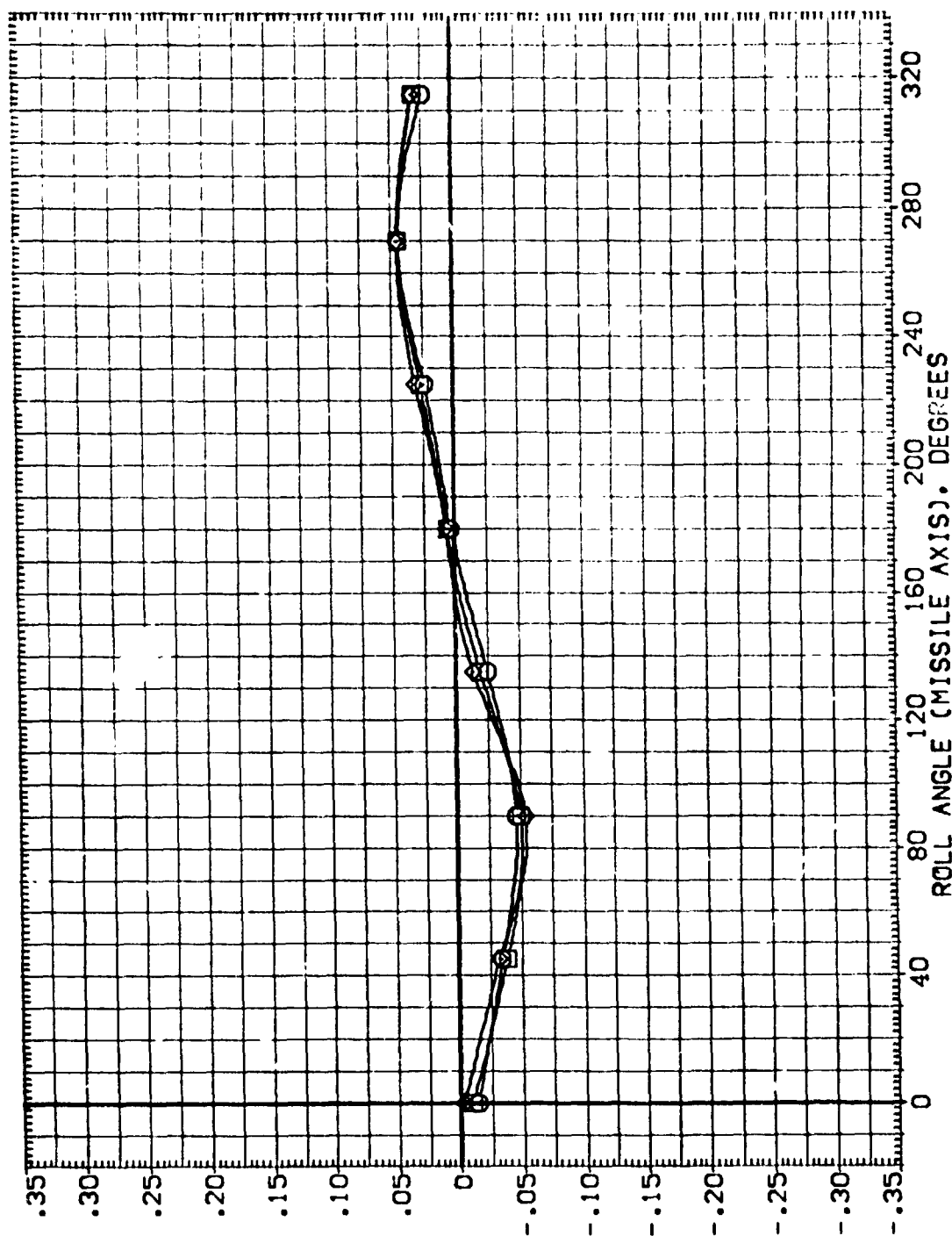
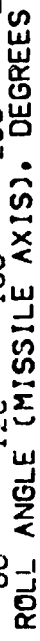


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(NE YMOI)

10.400

SREF
LREF
BREF
XMRP
YMRP
ZMRP
SCALE



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ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA	P	TRIC VALUES	REF	NCE INF	TION
15.	10.400	RN/L	59A.1	300.	50.FT.
20.			LREF	300.	IN.
25.			BREF	300.	IN.XT
30.000			XMRP	1406.	IN.YT
			YMRP	.	IN.ZT
			ZMRP	.	
			SCALE	.	

○ ◇ △

YAWING MOMENT COEFFICIENT (MISSILE AXIS), C_{YM}

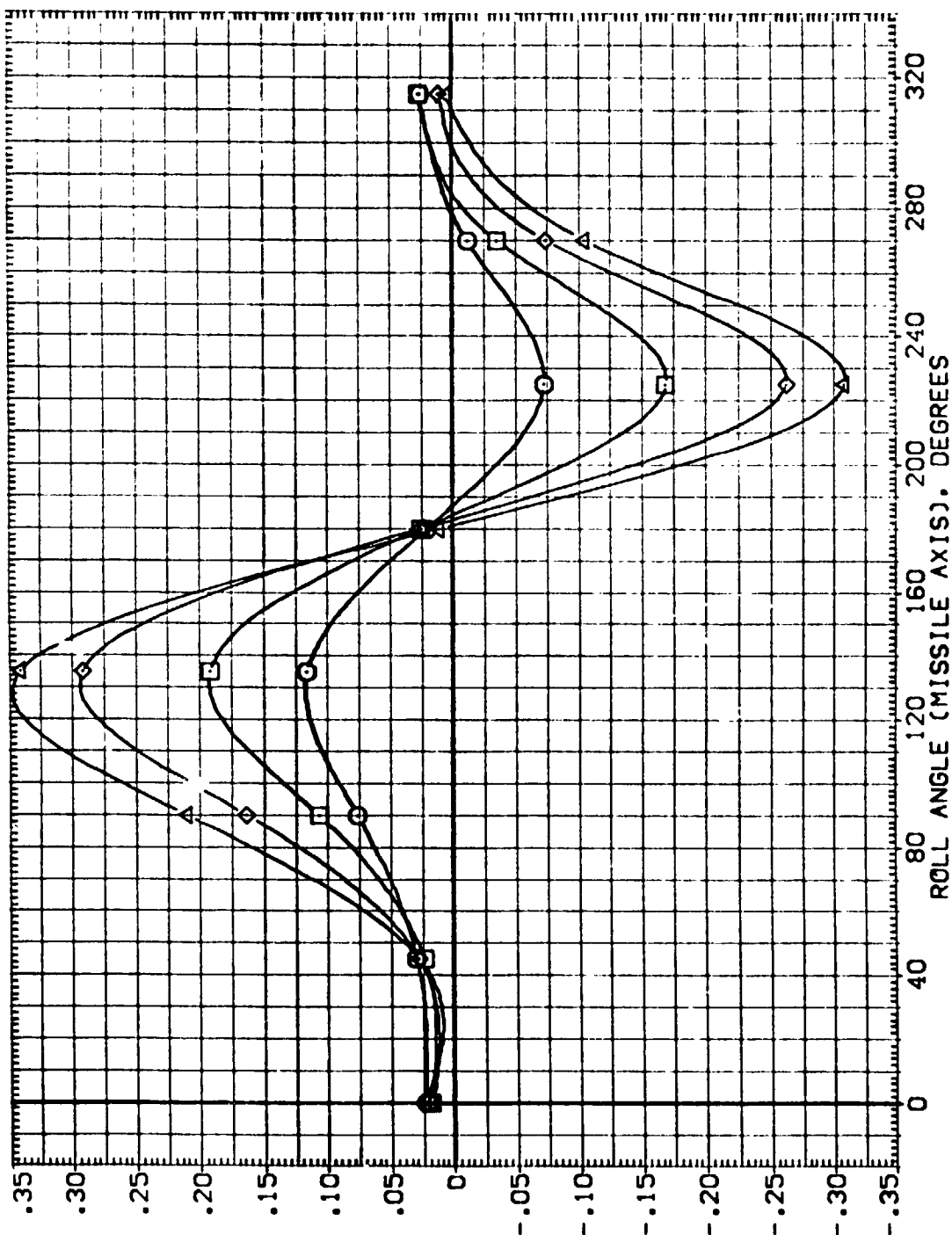


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA 30. 35. 40.000 45.000
 MACH 10.400 RN/L 1.160
 TION 50.FT. IN. IN.XT IN.YT IN.ZT
 REFERENCE INF 594.1 330. 330. 1406.
 LREF BREF XMRP YMRP ZMRP SCALE
 S O O O O

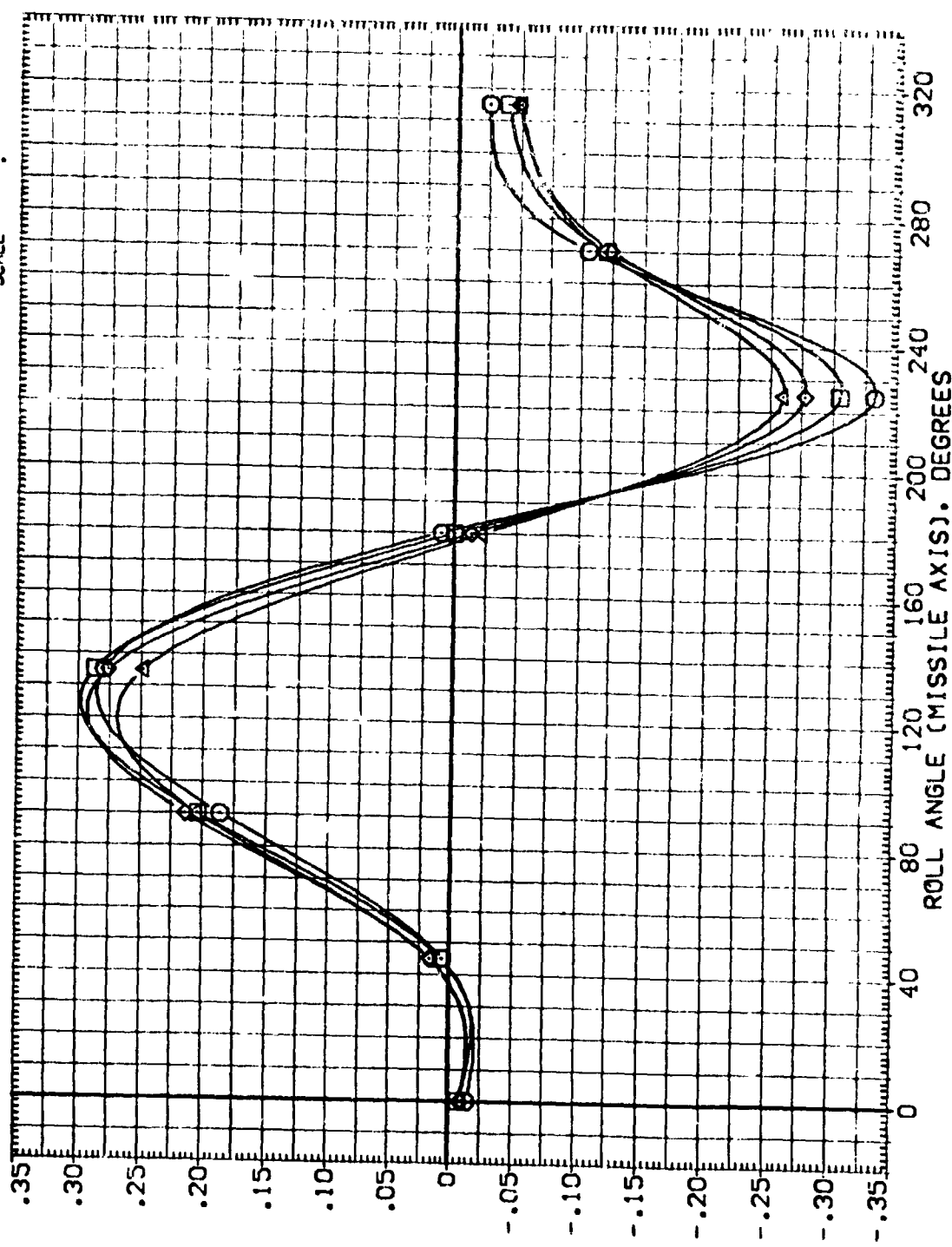


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 1.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA 50. 55. 60.000 70.000
 S \square \diamond \triangle
 P 10.400 TRIC VALUES 1.160
 REFERENCE INFORMATION
 SREF 594.1360 50.FT.
 LREF 330. IN.
 BREF 330. IN.XT
 XMRP 1406. IN.YT
 YMRP . IN.ZT
 ZMRP .
 SCALE .

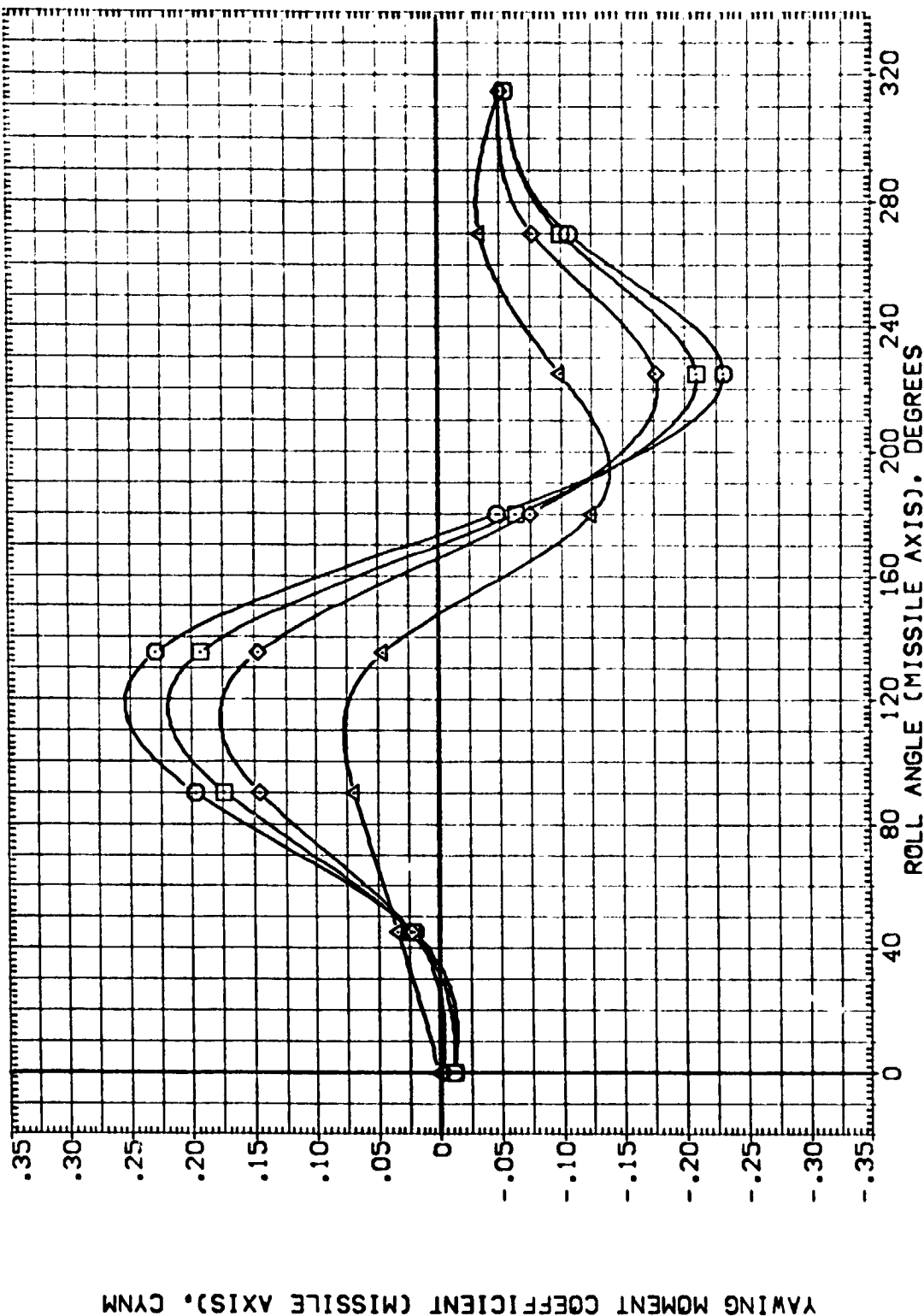


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHAS: 75. 80. 85. 90.
 SYMBS: \square \diamond Δ
 PARAMETRIC VALUES: 10.400 RV/L 1.160
 REFERENCE INF: 594.1 330. 330. 1406.
 SREF: 594.1 330. 330. 1406.
 LREF: 594.1 330. 330. 1406.
 BREF: 594.1 330. 330. 1406.
 XREF: 594.1 330. 330. 1406.
 YREF: 594.1 330. 330. 1406.
 ZREF: 594.1 330. 330. 1406.
 SCALE: .

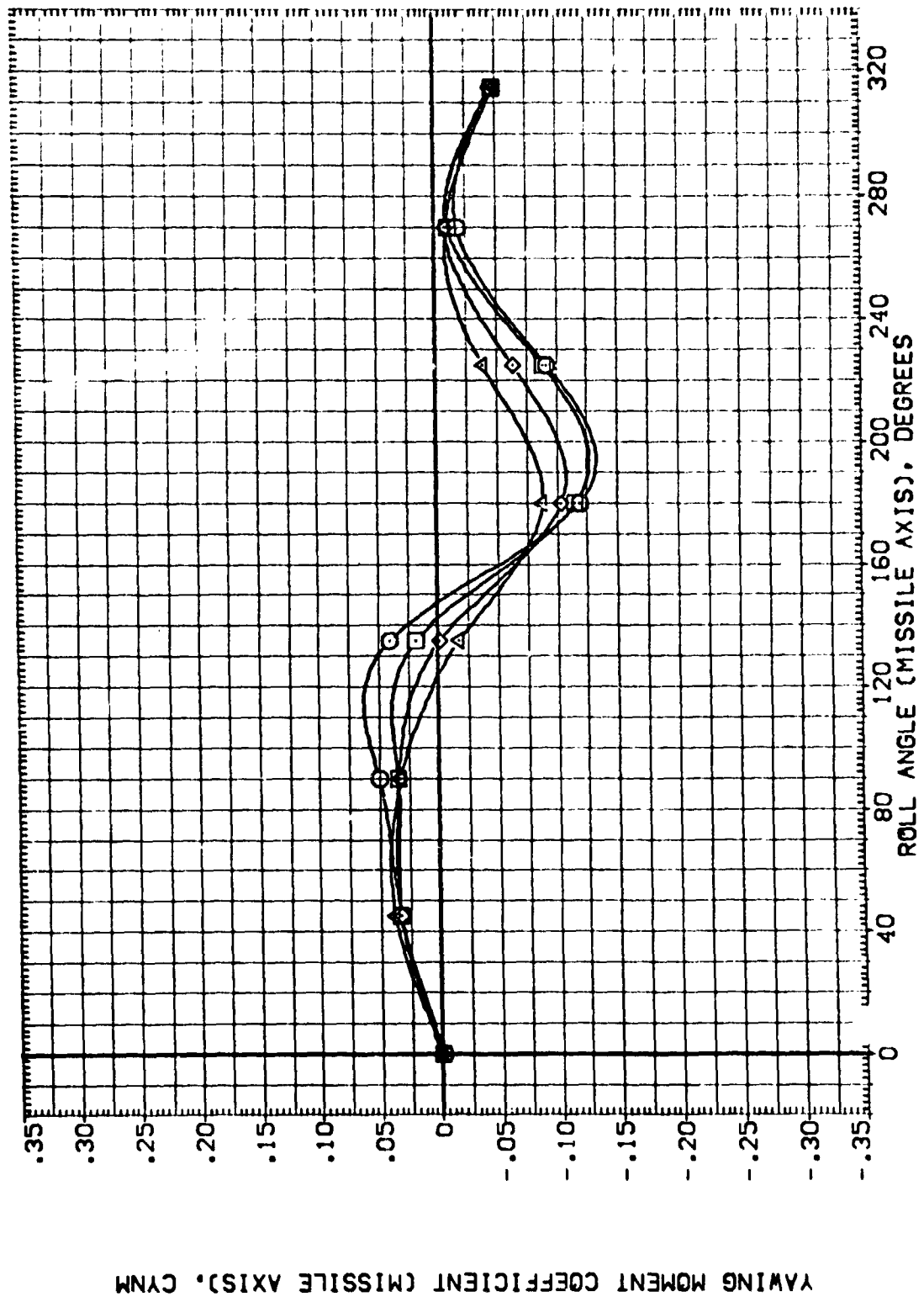


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	P	TRIC VALUES	REF	INFORMATION
95.	MACH	10.400	594.1360	50.FT.
100.	RV/L	1.160	330.	IN.
105.000			330.	IN.XT
110.000			1406.	IN.YT
				IN.ZT
				SCALE

○ □ ◇ △

YAWING M NT COEFFICIENT (MISSILE AXIS), CYNM

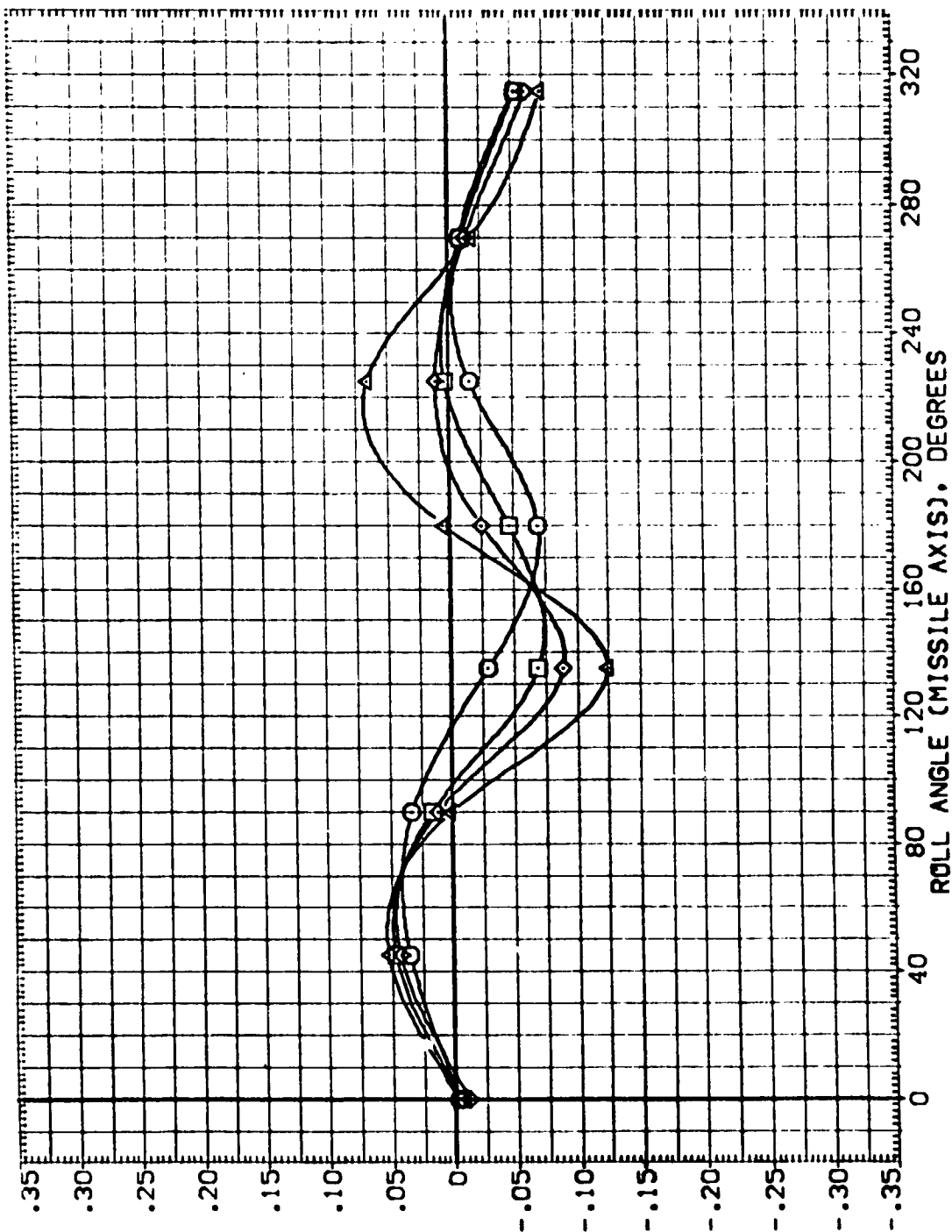


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA 115.000 MACH 10.400 RN/L 1.160
 120.000
 125.000
 130.000
 S \square \diamond \triangle

REFERENCE INF TION
 SREF 594.1360 SQ.FT.
 LREF 330.2000 IN.
 BREF 330.2000 IN.
 XMRP 1406.0000 IN.
 YMRP .0000 IN.
 ZMRP .0000 IN.
 SCALE .0080 IN.

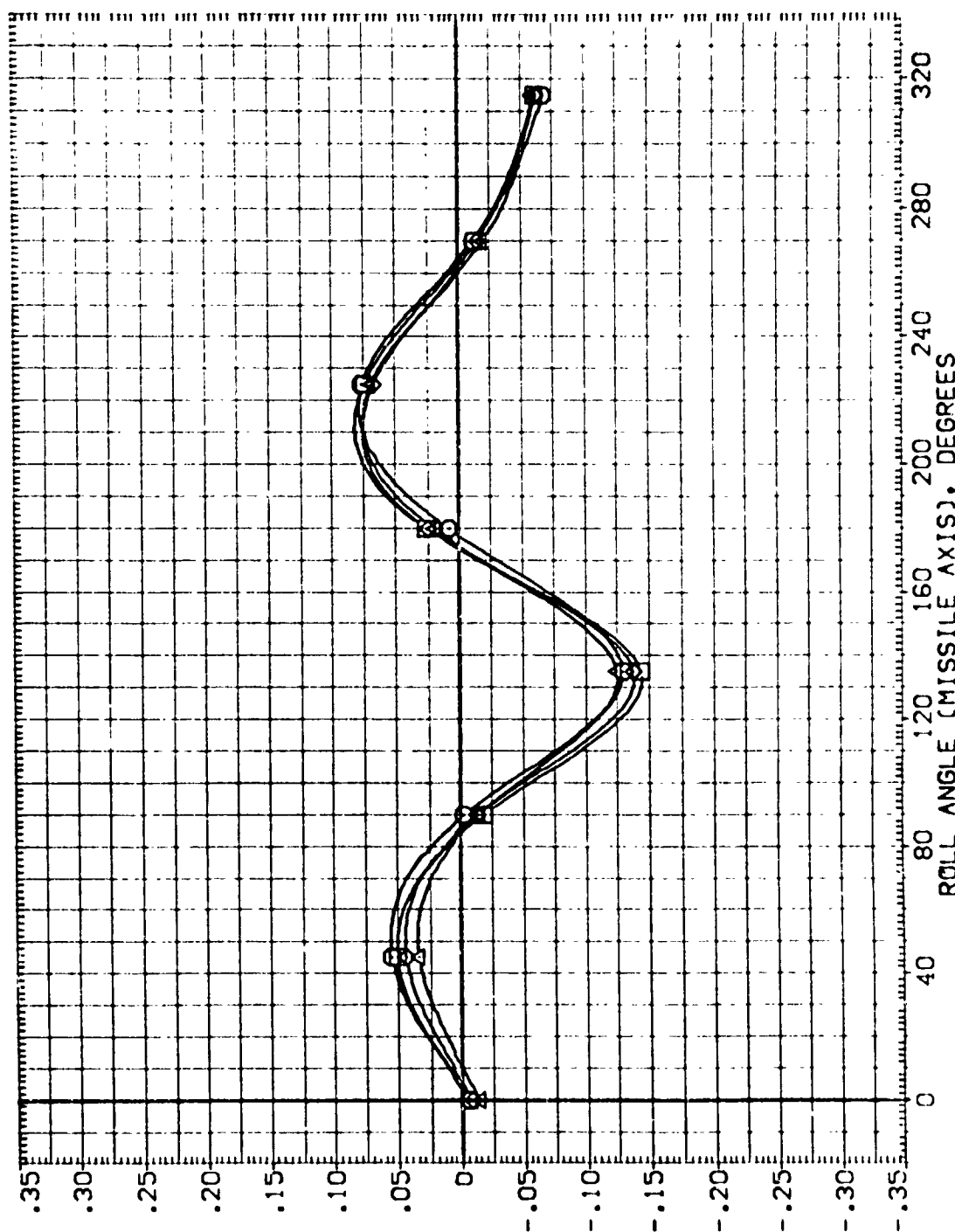


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-1.00 TANK WITH PROTUBERANCES (NEYMO1)

REFERENCE INF
 SREF 594.1360
 LREF 330.
 BREF 330.
 YMRP 1406.
 ZMRP :
 SCALE :

ALPHA 135.000
 140.000
 145.000
 150.000

S 00001

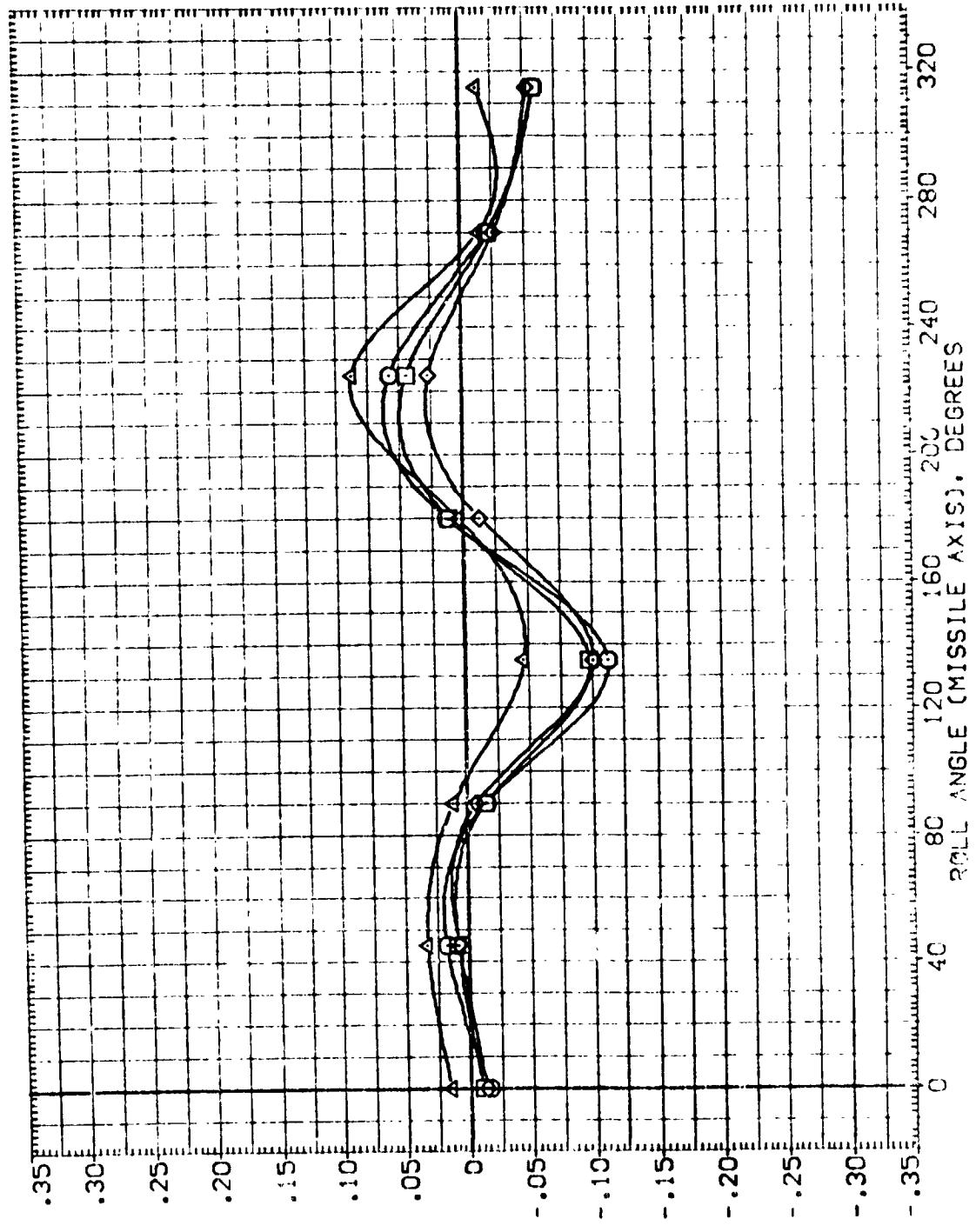


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMD1)

REFERENCE
 SREF 594.1360
 LREF 330.
 BREF 330.
 XREF 1406.
 YREF .
 ZREF .
 SCALE .

PARAMETRIC VALUES
 10.400 RN/L 1.160
 ALPHA
 155.000
 160.000
 165.000
 170.000

○ □ ◇ △

YAWING MOMENT COEFFICIENT (MISSILE AXIS), C_{YM}

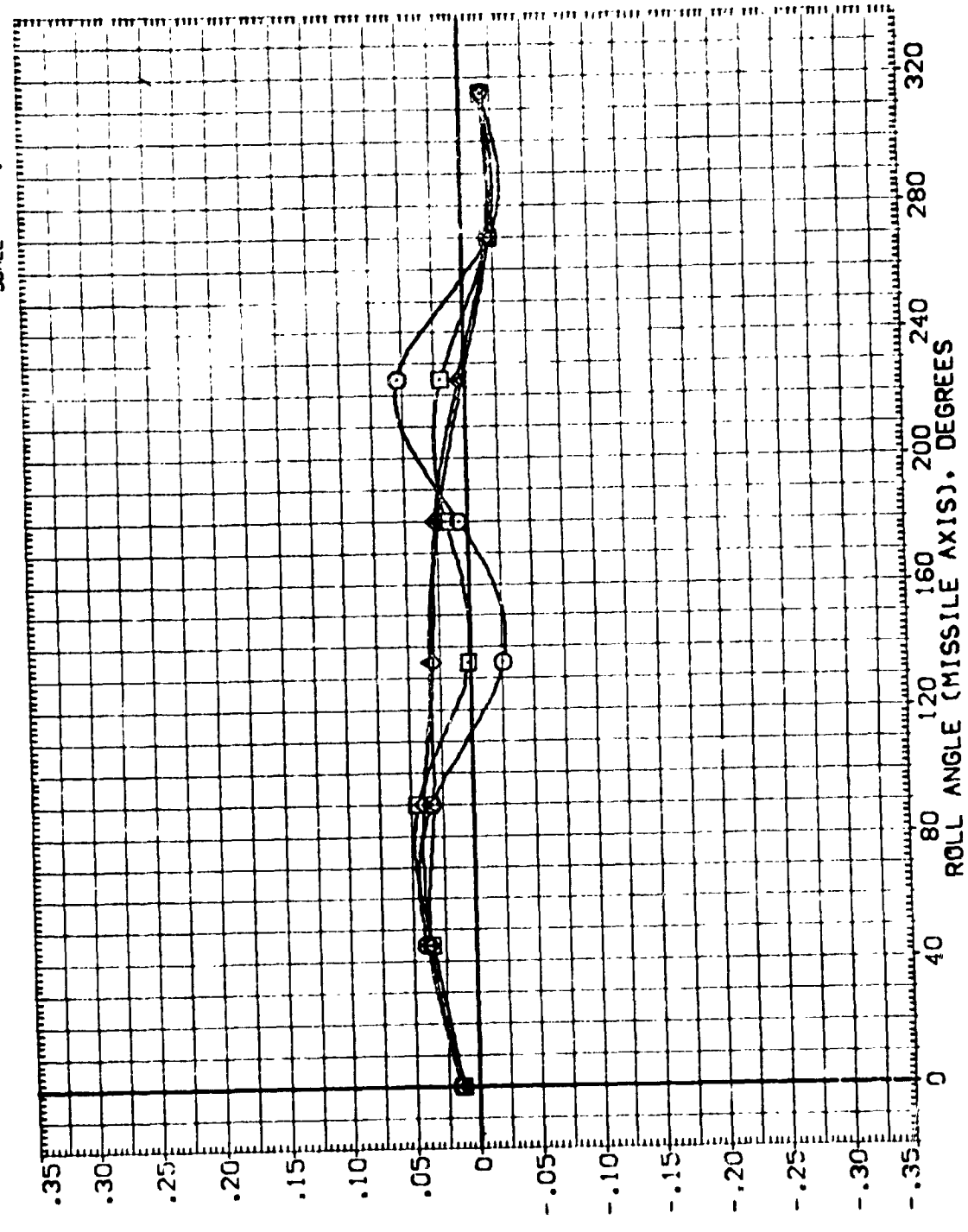
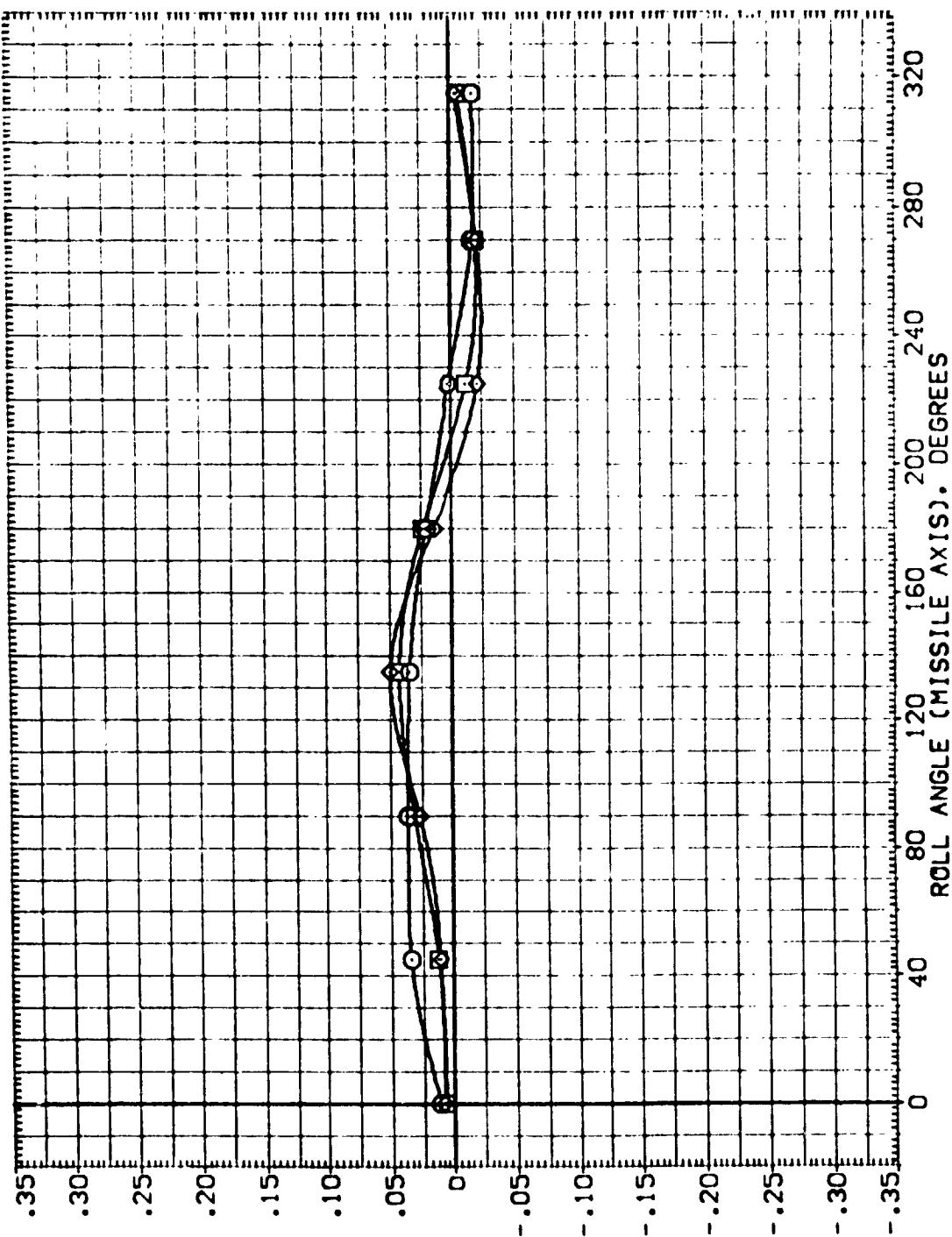


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYM01)

P 10.400 TRIC VALUES 1.180
 175. 160. 185.
 10.400 RV/L
 LREF F 330.
 YAPP 1406.
 SCALE .1
 INF 90.FT.
 TION N.
 N. XT
 N. YT
 N. ZT



YAWING MOMENT COEFFICIENT (MISSILE AXIS), C_{YM}

ROLL ANGLE (MISSILE AXIS), DEGREES

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEUMO1)

SREF	594.1
LREF	330.
BREF	330.
XRRP	1406.
YRRP	.
SCALE	.
REFERENCE :	
TION	\$0.FT. IN. IN. IN.XT IN.YT IN.ZT

P TRIC VALUES
10.400 1.160

-5. 5. 10.

○ □ ◇ △

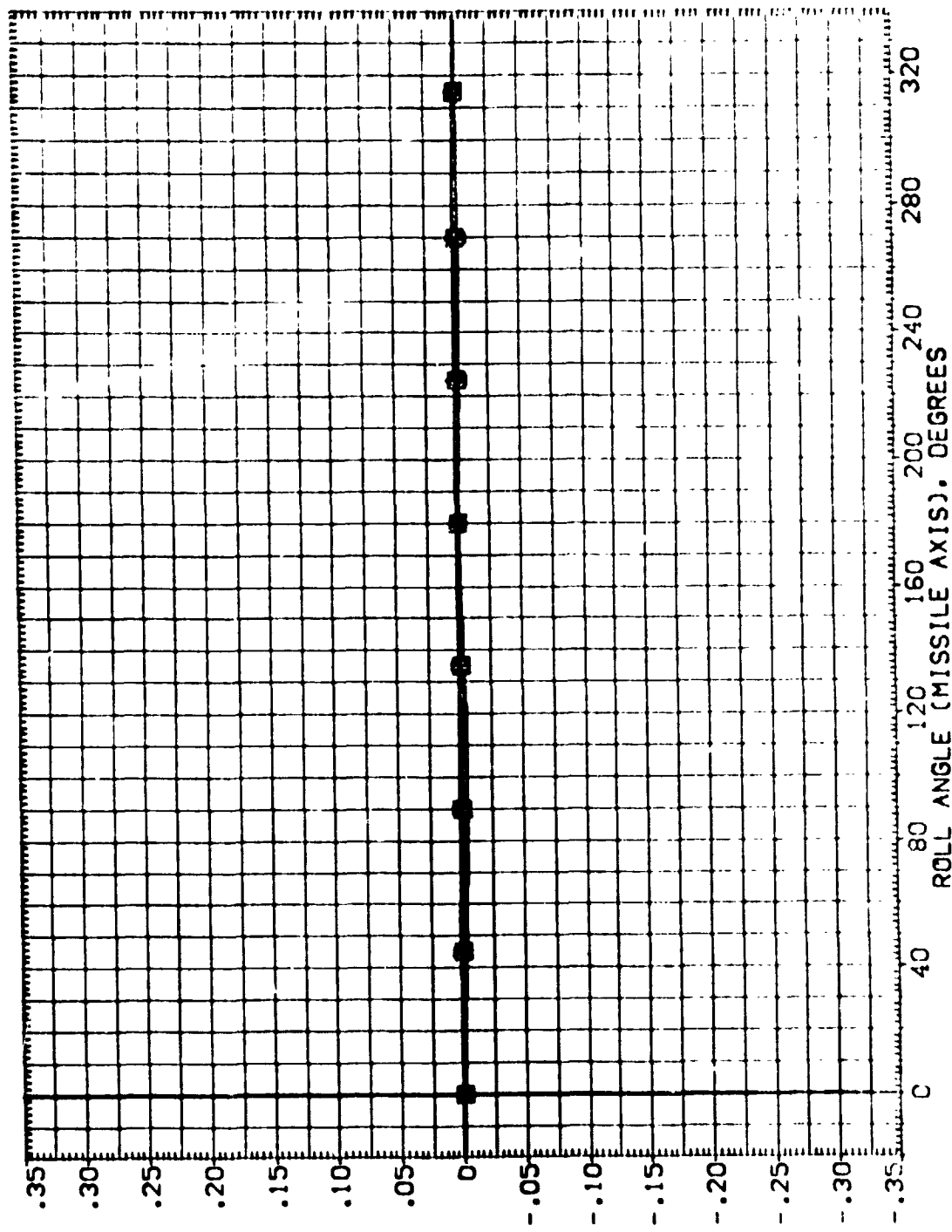


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(NYMO1)

	TRIC V	S	REF	INF	TION
15.	10.400	1.160	SREF	330.	50.57.
20.			LREF	330.	IN.
25.000			BREF	330.	IN.
30.			XREF	1406.	IN.
			YREF		IN.
					IN.
			SCALE	.0060	IN.

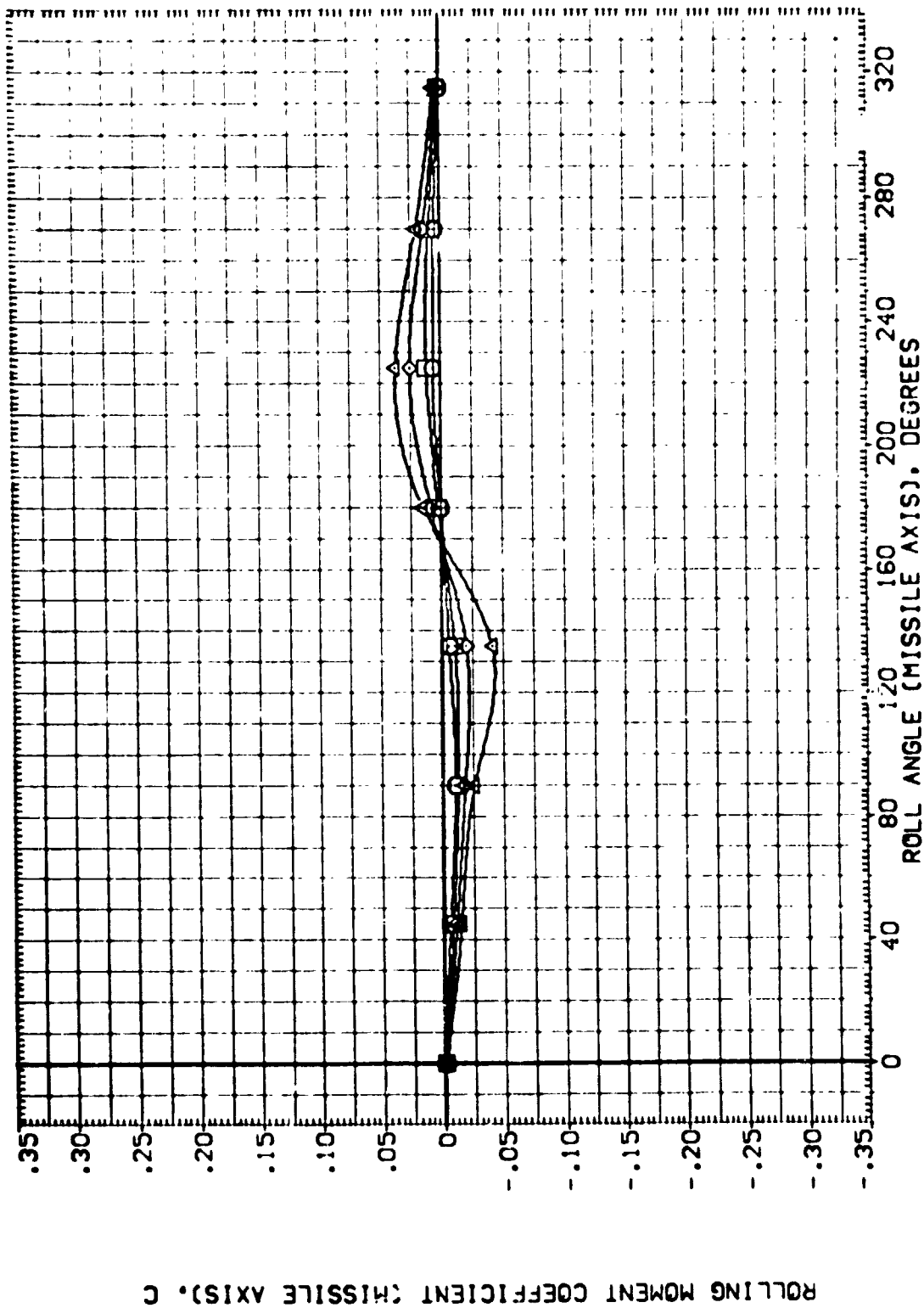


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYMO1)

30.
 35.
 40.
 45.
 P 10.400 RNU 1.160
 TRIC VALUES
 REFERENCE I
 SREF 291.1
 LREF 330.
 BREF 330.
 XREF 1406.
 YREF .
 ZREF .
 SCALE
 TION
 50.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT

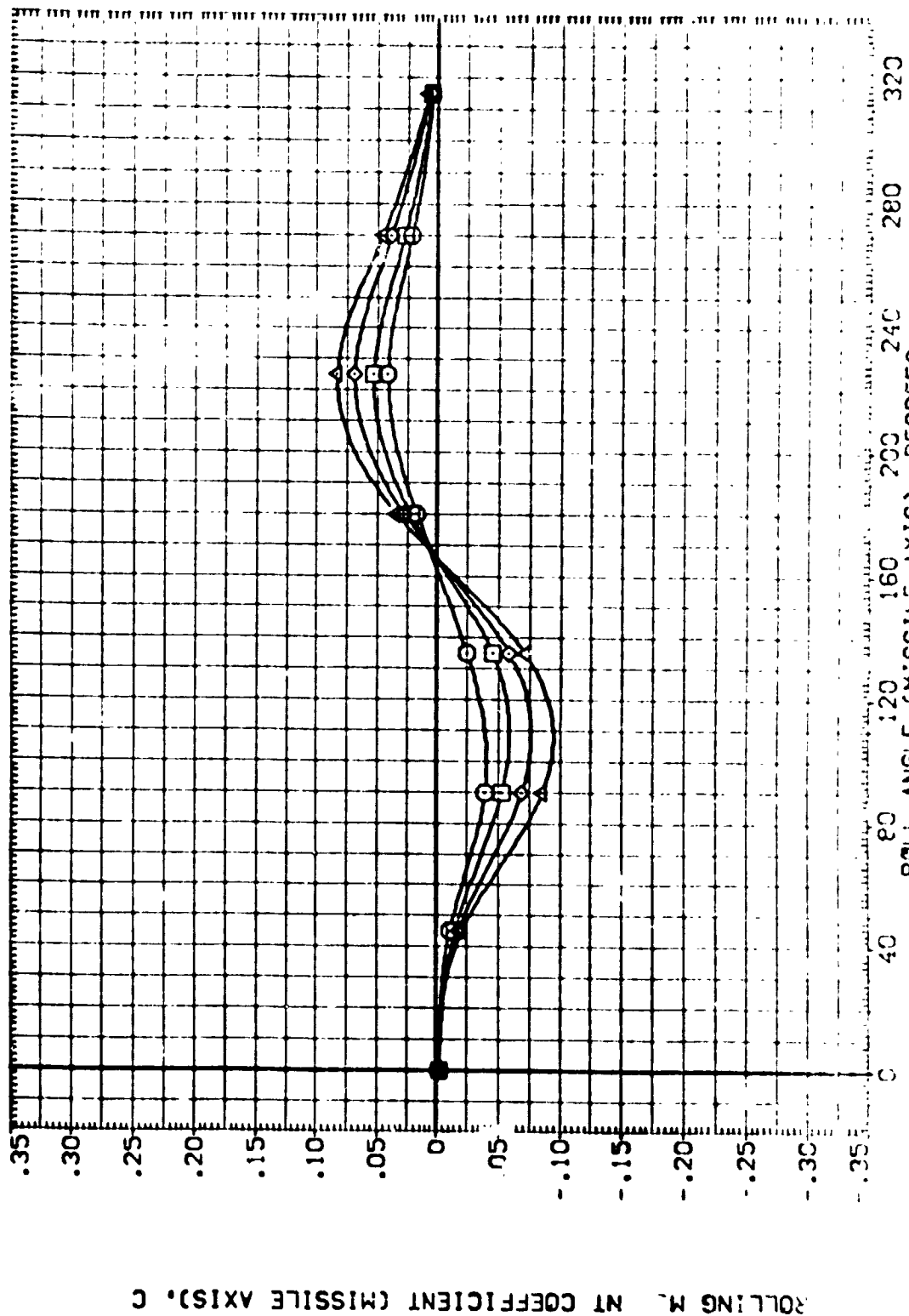


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA 50.000
55.000
60.000
70.000

□ ◇ △

PARAMETRIC VALUES
10.400 RN/L 1.160

REFERENCE INFORMATION
SREF 594.1360
LREF 337.7000
BREF 330.2000
XREF 1406.
YREF .0000
ZREF .0000
SCALE .0060

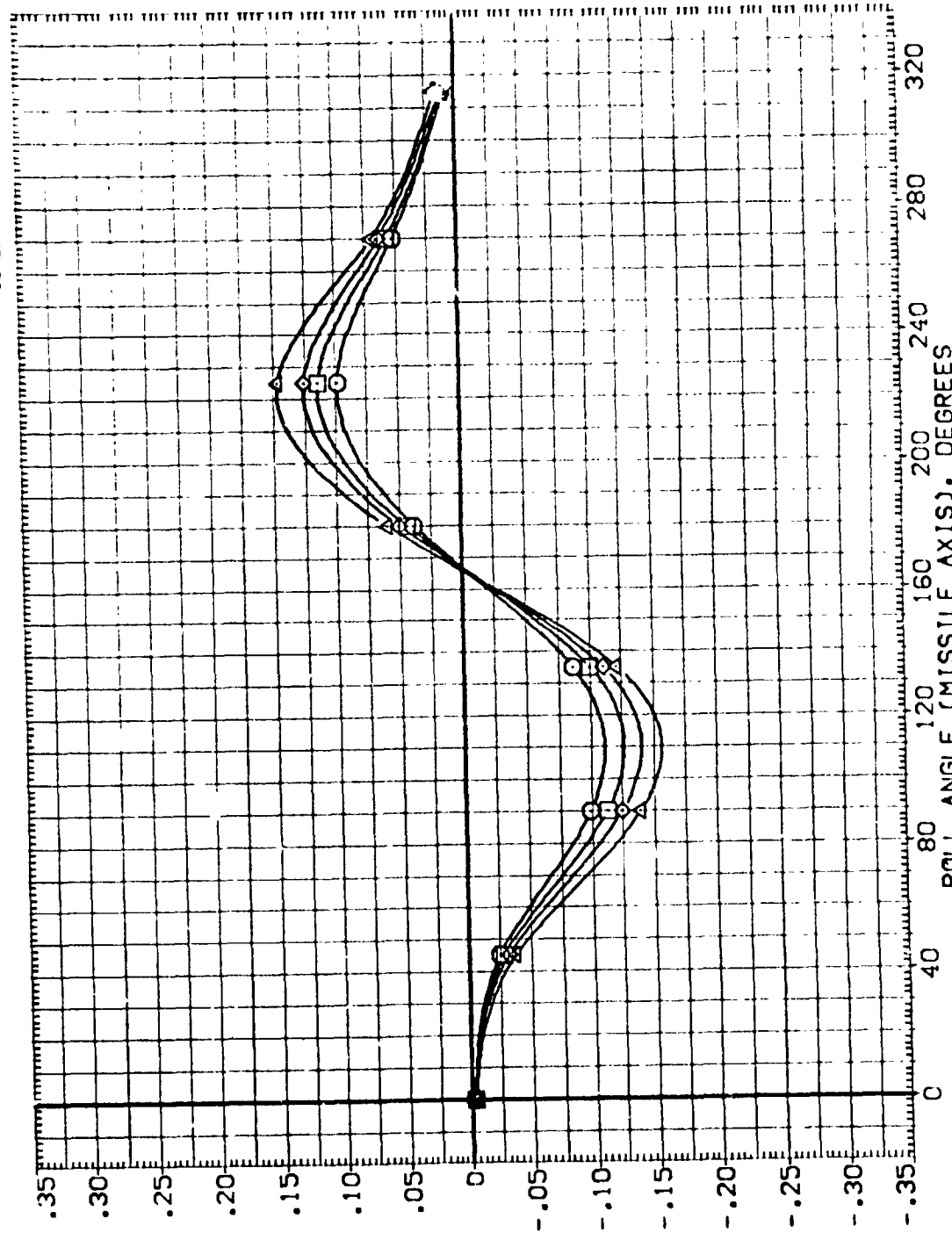


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA
75.000
80.000
85.000
90.000

PARAMETRIC VALUES
10.400 RN/L 1.160

REFERENCE INF
SREF 594.1360
LREF 330.
BREF 330.
XMRP 1406.
YMRP .
ZMRP .
SCALE .

□ □ ◇ ◇

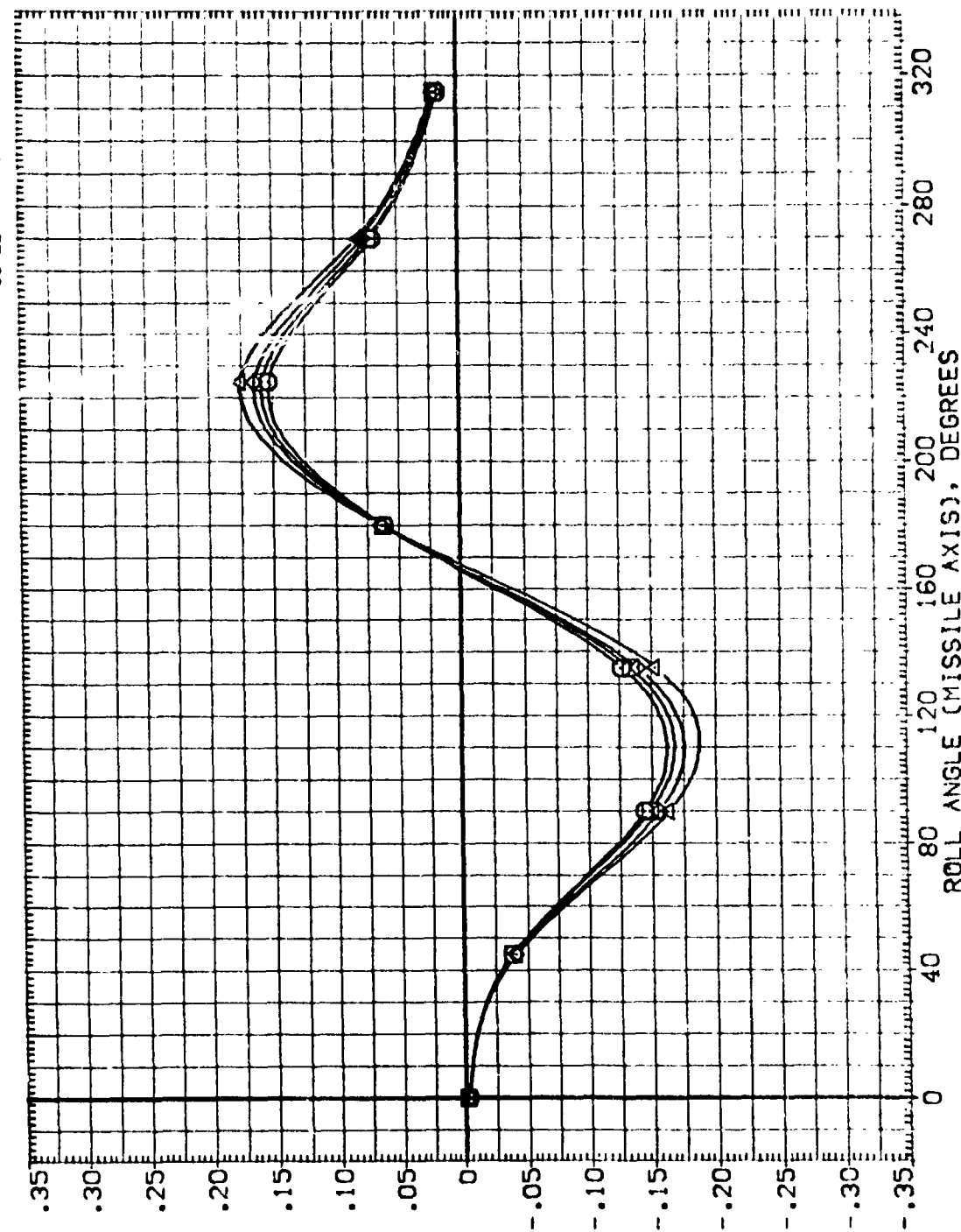


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

ALPHA	PARAMETRIC VALUES	REFERENCE INFORMATION
95.000	10.400 RV/L	SREF 594.1360
100.000	1.160	LREF 330.2000
105.000		BREF 330.2000
110.000		YMRP 1406.0000
		ZMRP .0000
		SCALE .0000

◇ □ ○ △

ROLLING MOMENT COEFFICIENT (MISSILE AXIS), CBL

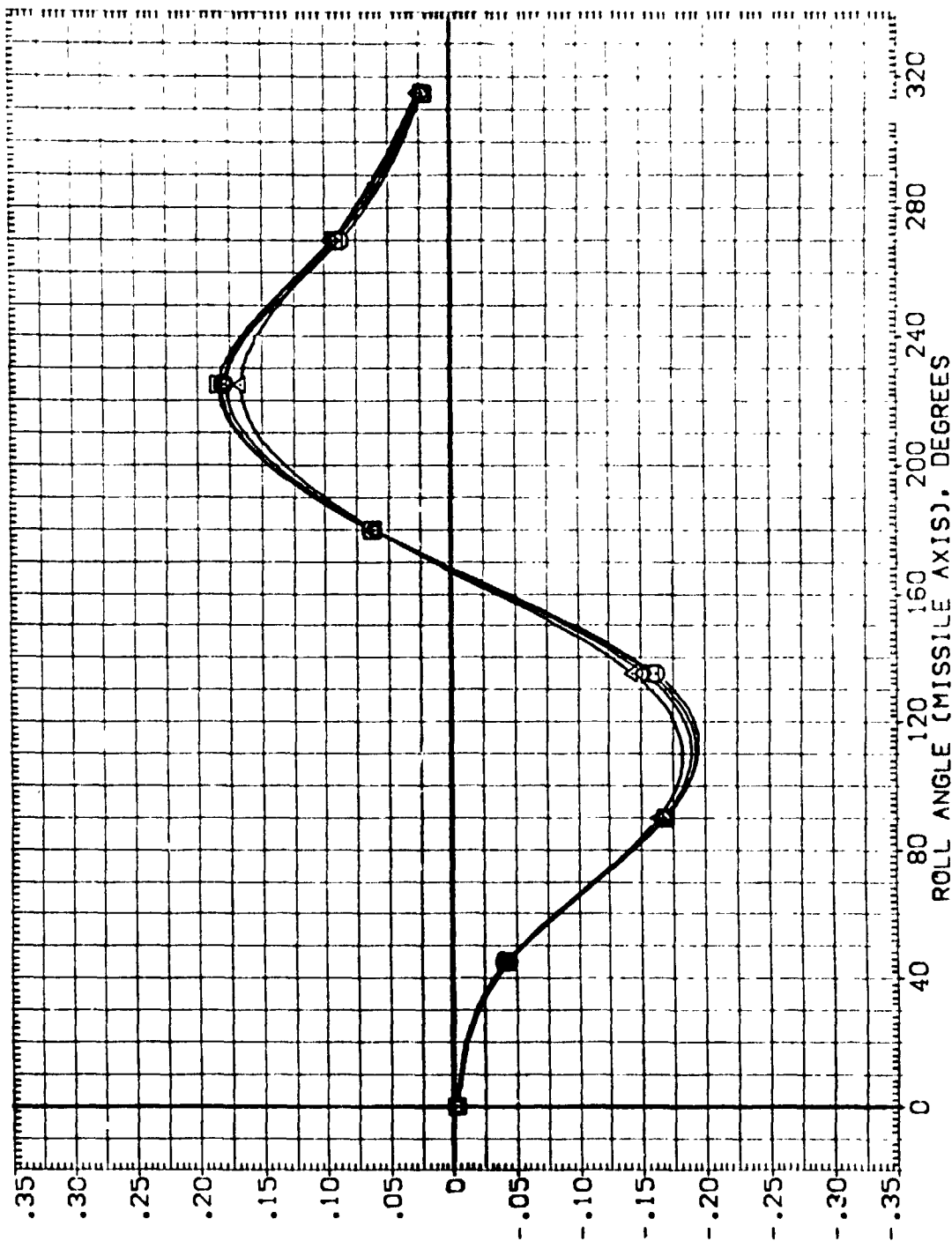


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES)

PARAMETRIC VALUES		REFERENCE INFORMATION	
ALPHA	MACH		SO.FT.
115.000	10.400	SRF	594.1360
120.000		LRF	330.
125.000		BRF	330.
130.000		YMRP	1406.0000
		YMRP	.0000
		YMRP	.0000
		ZMRP	.0000
		SCALE	.0060

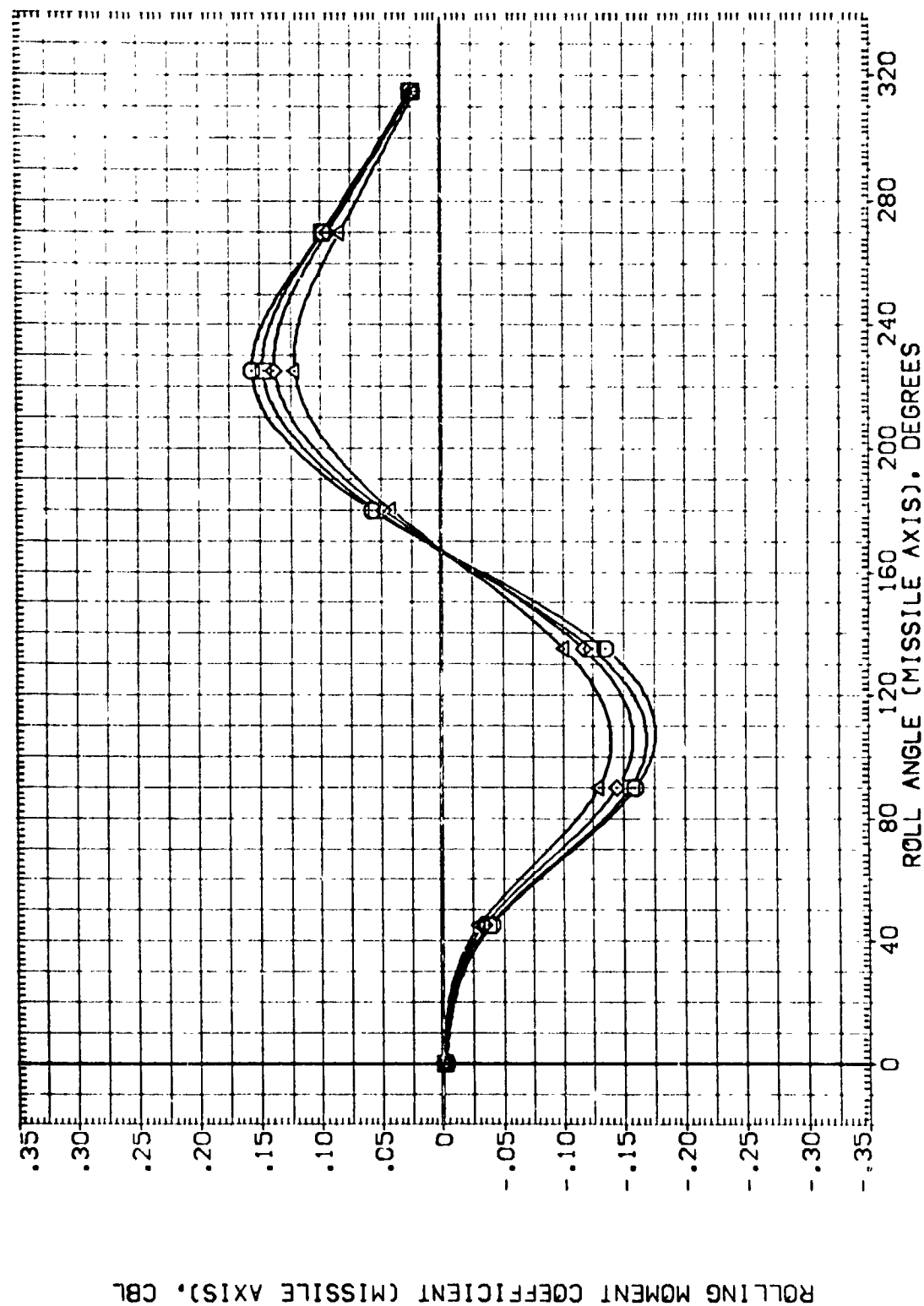


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGE ET (TANK WITH PROTUBERANCES) (NEYMO:1)

S	ALPHA	PARAMETRIC VALUES		REFERENCE INFORMATION	
		10.00	R/V/L	SREF	50.FT.
1	135.000	1.00	1.160	LREF	330.2000
2	140.000			BREF	330.2000
3	145.000			XREF	1408.0000
4	150.000			YREF	0.0000
				ZREF	0.0000
				SCALE	0.0060

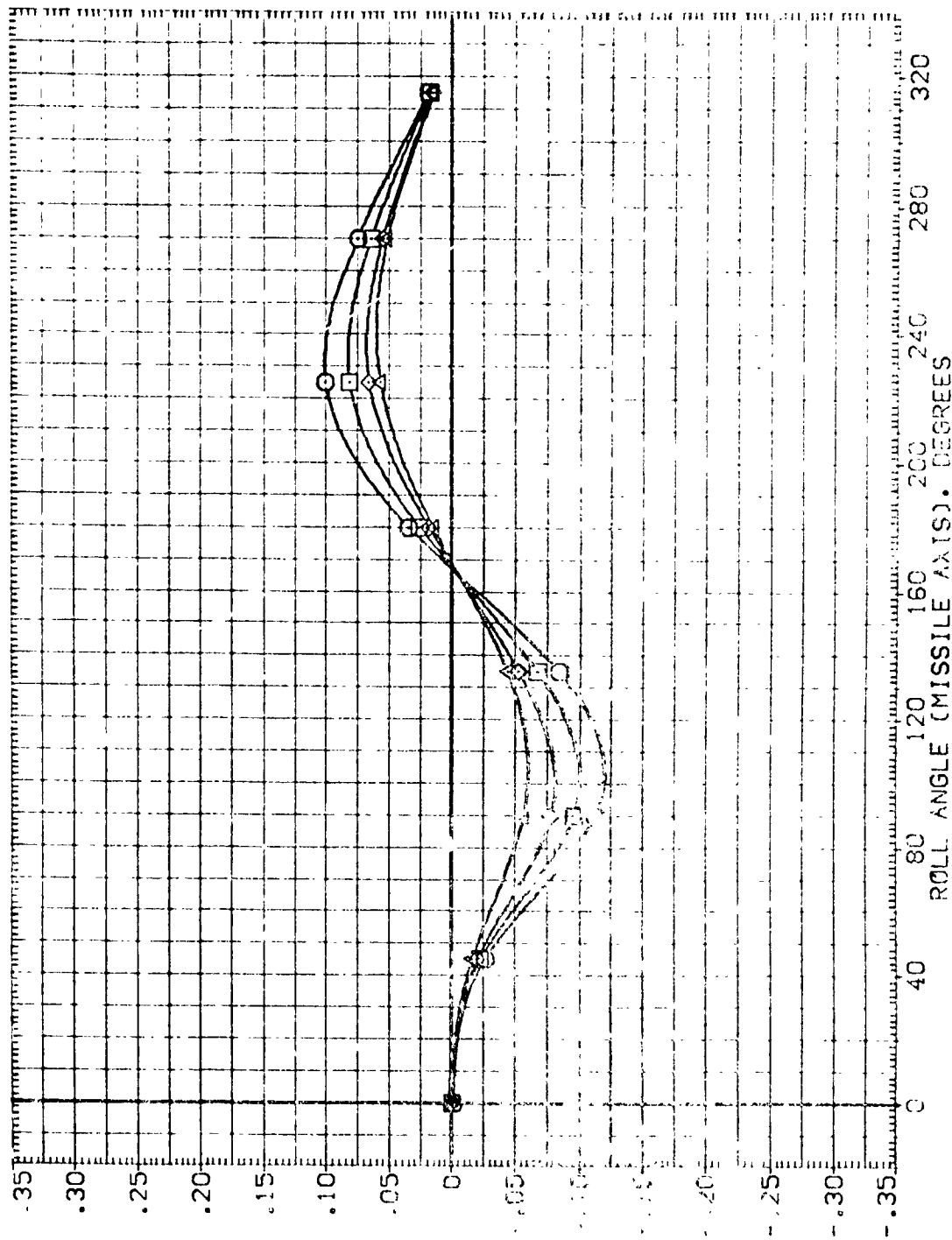


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	MACH	PARAMETRIC VALUES	REFERENCE INFORMATION
155.000	1.160	10.400 RV/L	SREF 594.1360 SQ.FT.
160.000			LREF 330.2000 IN.
165.000			BREF 330.2000 IN.
170.000			XMRP 1406.0000 N.YT
			YMRP .0000 N.YT
			ZMRP .0000 N.ZT
			SCALE .0060

○ □ ◇ △

ROLLING MOMENT COEFFICIENT (MISSILE AXIS), CBL

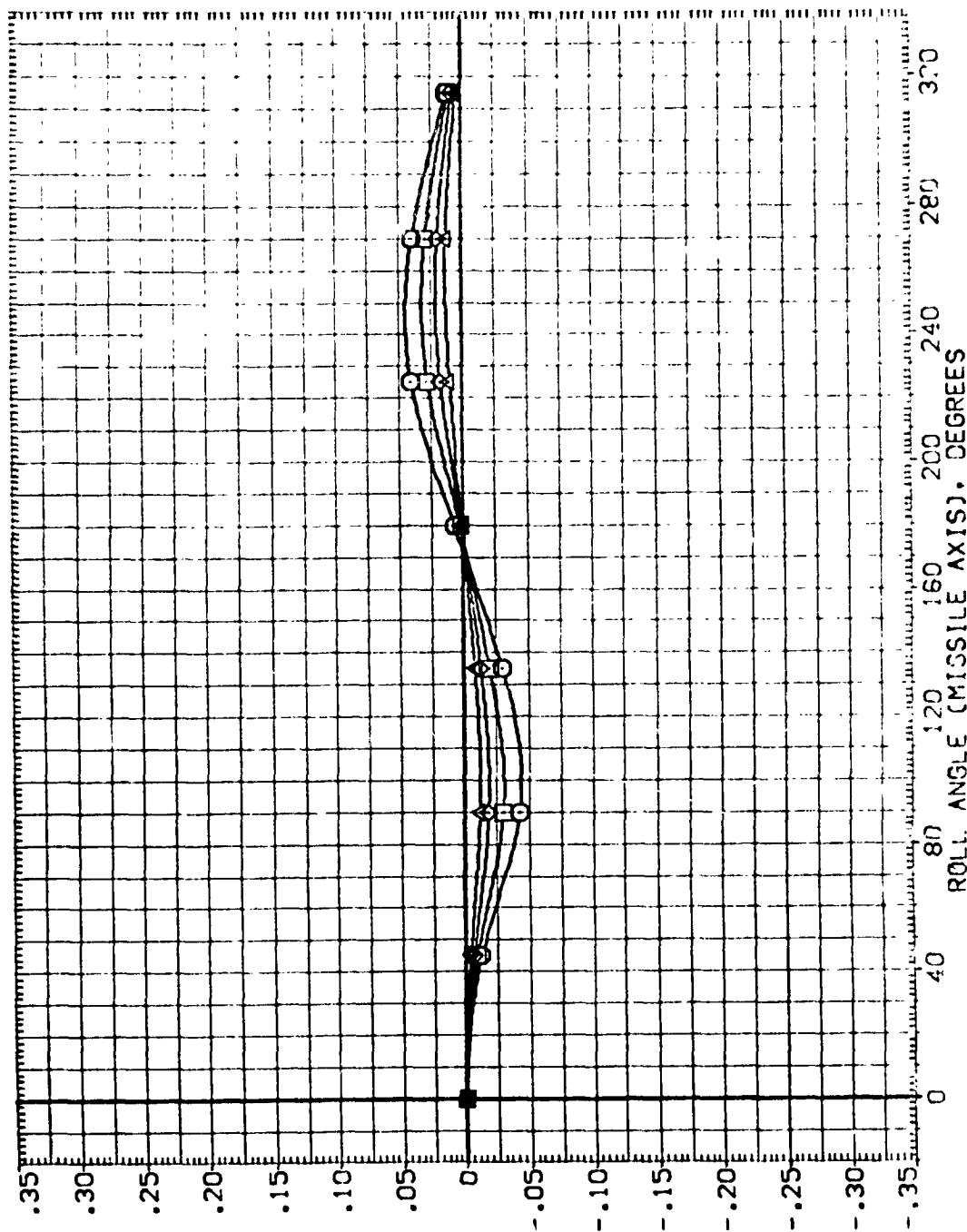


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

(END)

1.69

REF
LREF
BREF
XMRP
YMRP
ZMRP
SCALE

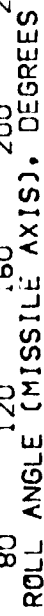


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 T9F ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA	MACH	PARAMETRIC VALUES	REFERENCE INF	TION
-5.		10.400	594.1360	50.FT.
.000		1.160	330.	IN.
5.000			330.	IN.XT
10.000			1406.	IN.YT
				IN.ZT
				SCALE

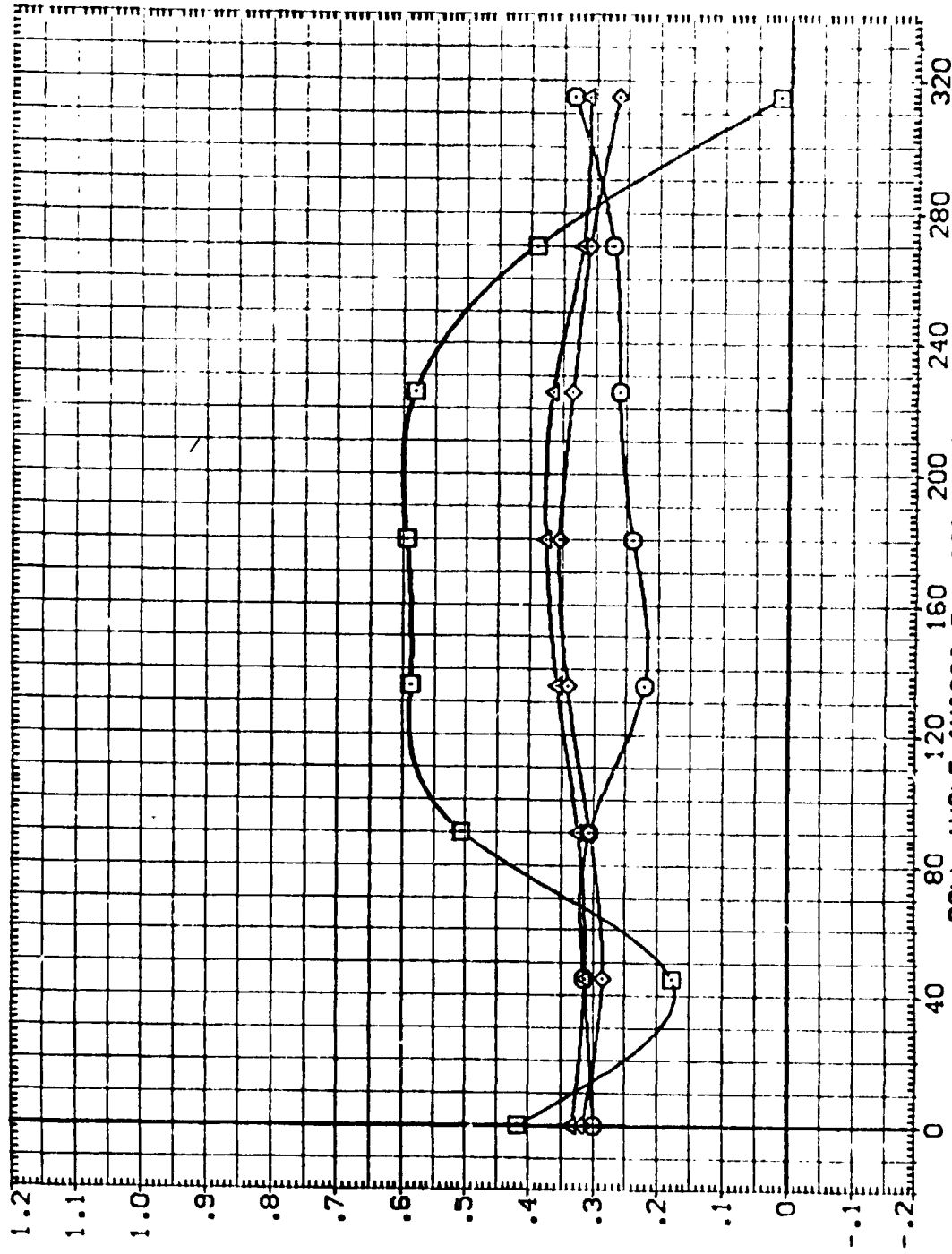


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

15. 20. 25. 30.

15. 20. 25. 30.

TRIC V 10. 1.100

REFE INF YION
LREF :1 SO.FT.
1406: IN.
IN. XT
IN. YT
IN. ZT

SCALE

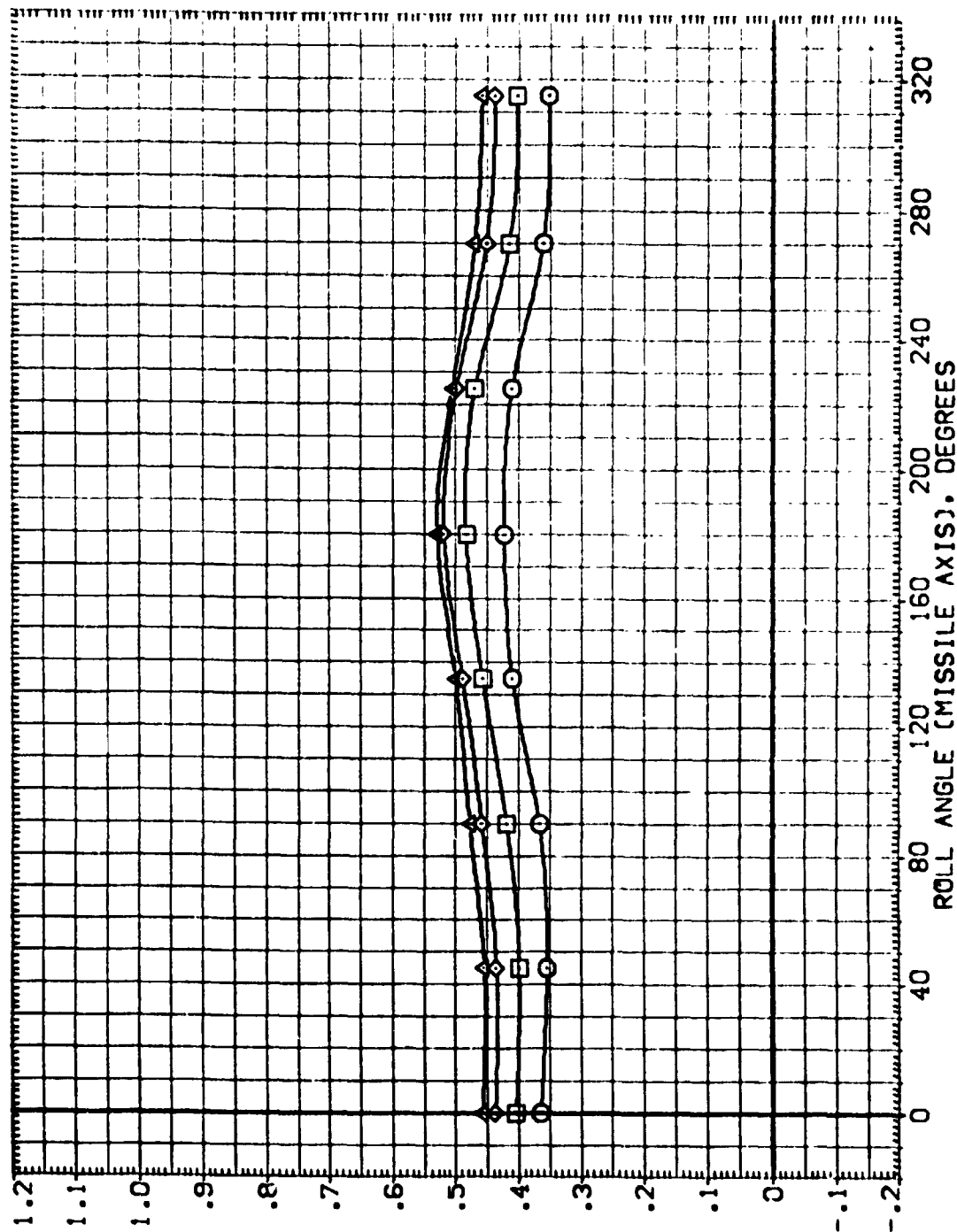


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

P 10.400
 TRIC VALUES 1.160
 REF 594.1360
 SREF 330.
 LREF 330.
 BREF 330.
 XPRP 1406.
 YPRP .
 ZPRP .
 SCALE .
 ACTION 50.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT

30.
 35.
 40.
 45.

□
 ◇
 △

CENTER OF PRESSURE LOCATION, XCP/L

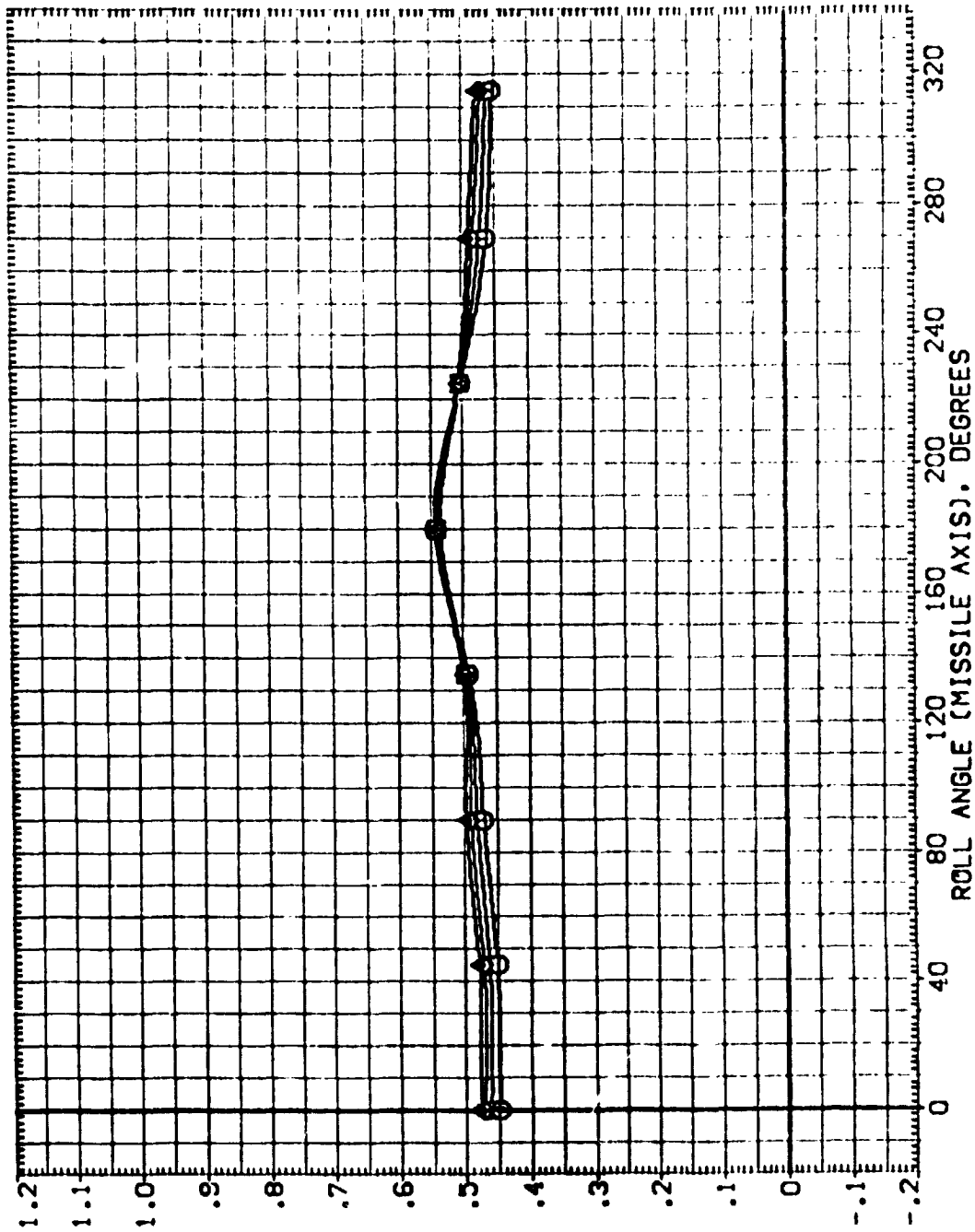
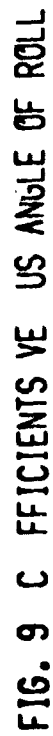


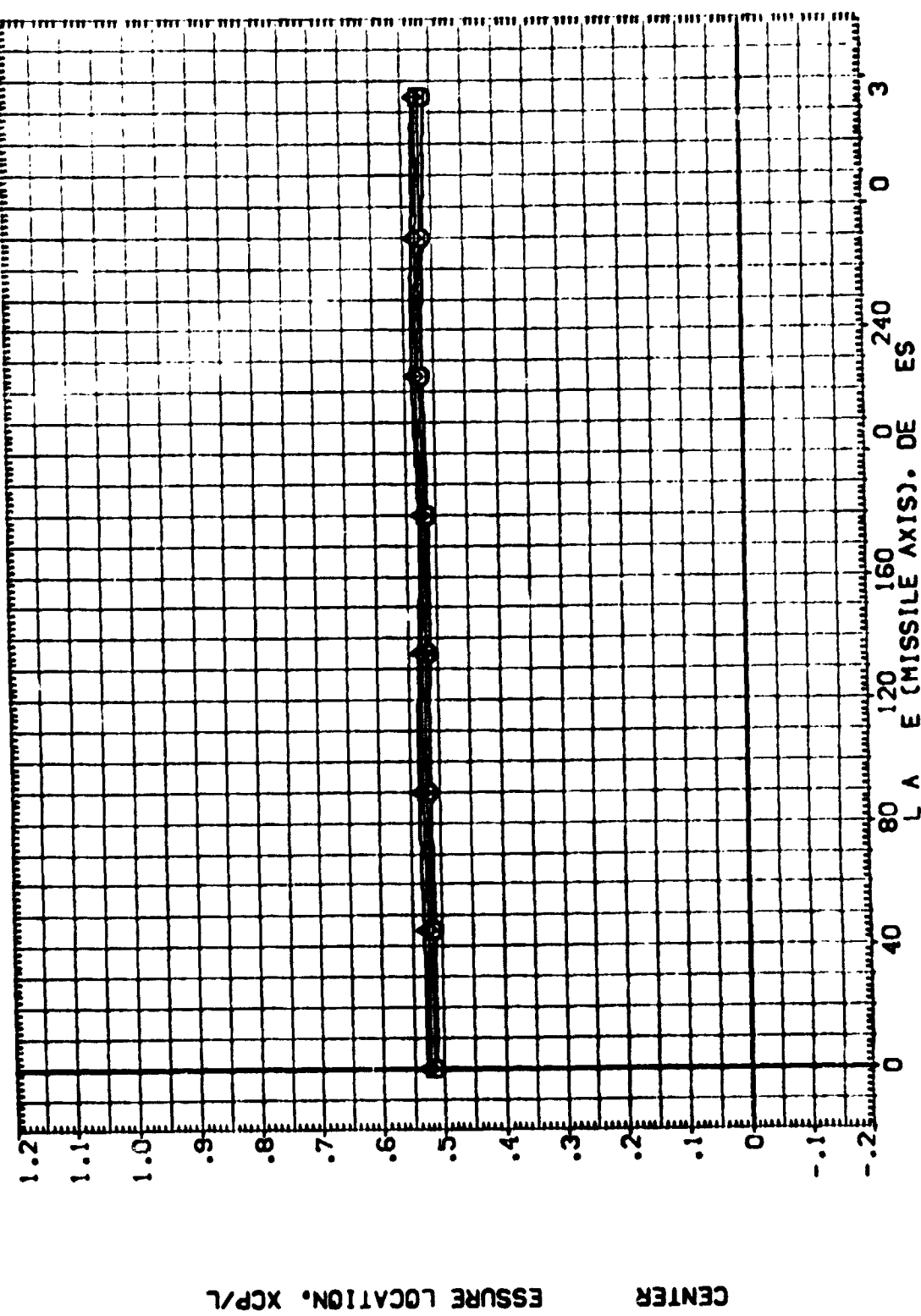
FIG. 9 COEFFICIENTS VERSUS A LE OF ROLL



A 3.5-1 TAGF ET (TANK WITH TUBERANCES) (NEYMO1)

4000
75: 80: 85: 90:

10. IC V S 1.160
LREF
E
TIGN
90.FT.
IN.
IN.XT
IN.YT
IN.ZT



CENTER
ESSURE LOCATION. XCP/L

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

४४६३

SCALE

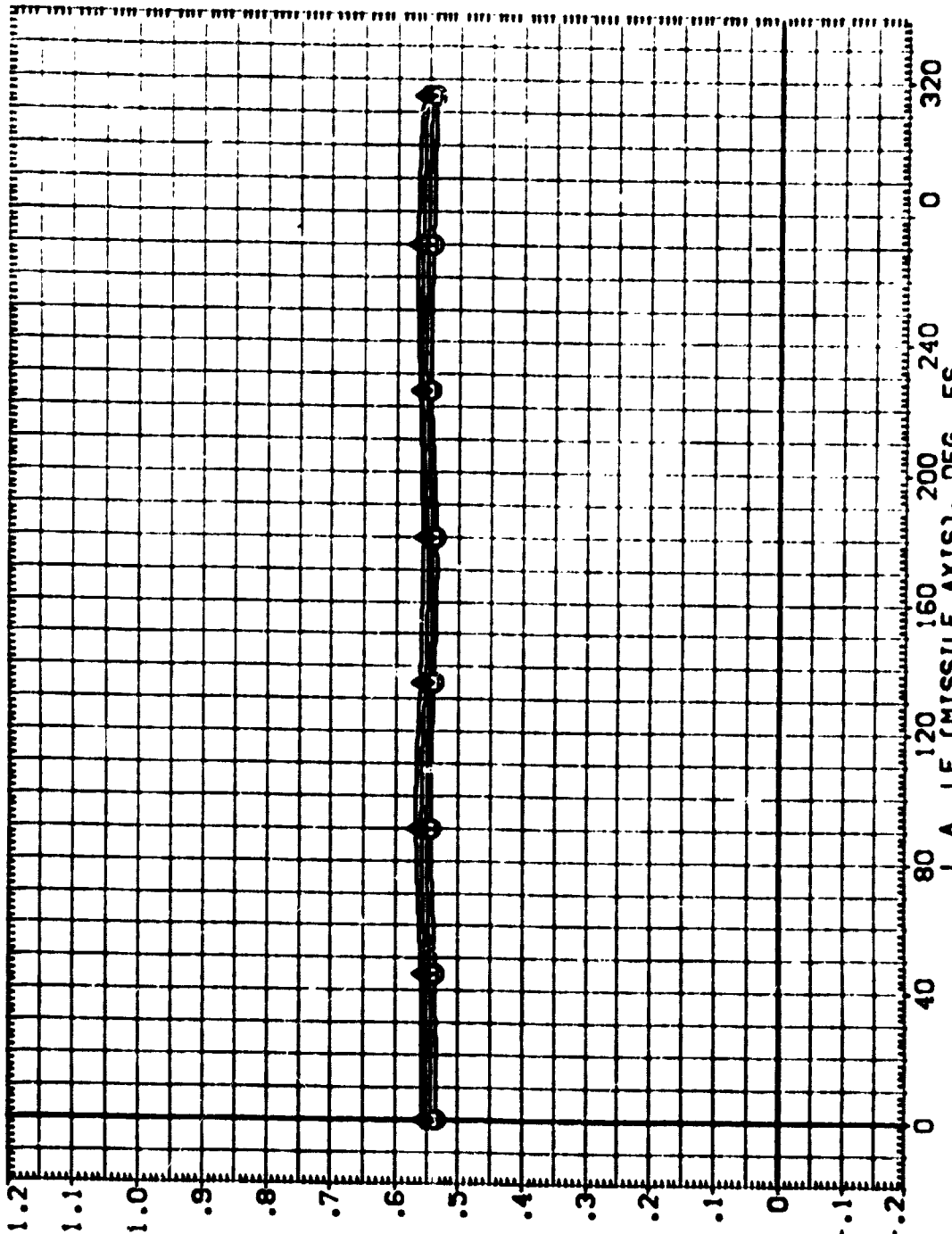


FIG. 9 C F FICIENTS VE
ANGLE OF LL

A 3.5-1 TAGF ET (TANK WITH P TU RANCES) (NEY 1)

115
 120
 125
 130

10.
 100
 1000

1
 .1
 .01
 .001

14
 14
 14
 14

1
 .1
 .01
 .001

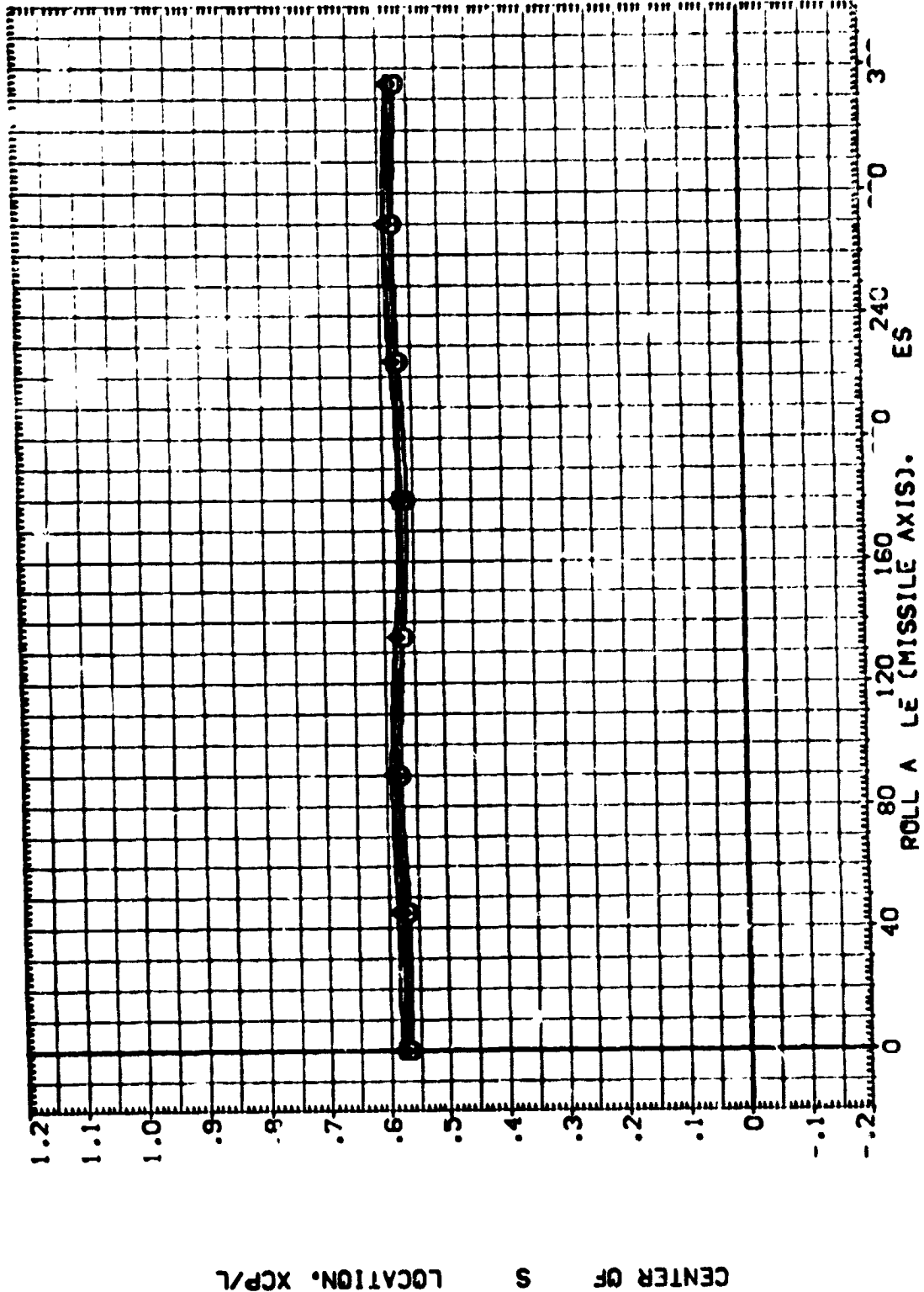


FIG. 3 C FFICIENTS VE ANGLE OF ROLL

SREF	594.1360	50.FT.
LREF	330.	IN.
BREF	330.	IN.
XMRP	1406.	IN.XT
YMRP	.	IN.YT
ZMRP	.	IN.ZT
SCALE	.	

PARAMETRIC VALUES	
10.410	RN/L
	1.150

ALPHA
135.
140.000
145.000
150.000

□ □ ◇ ◀

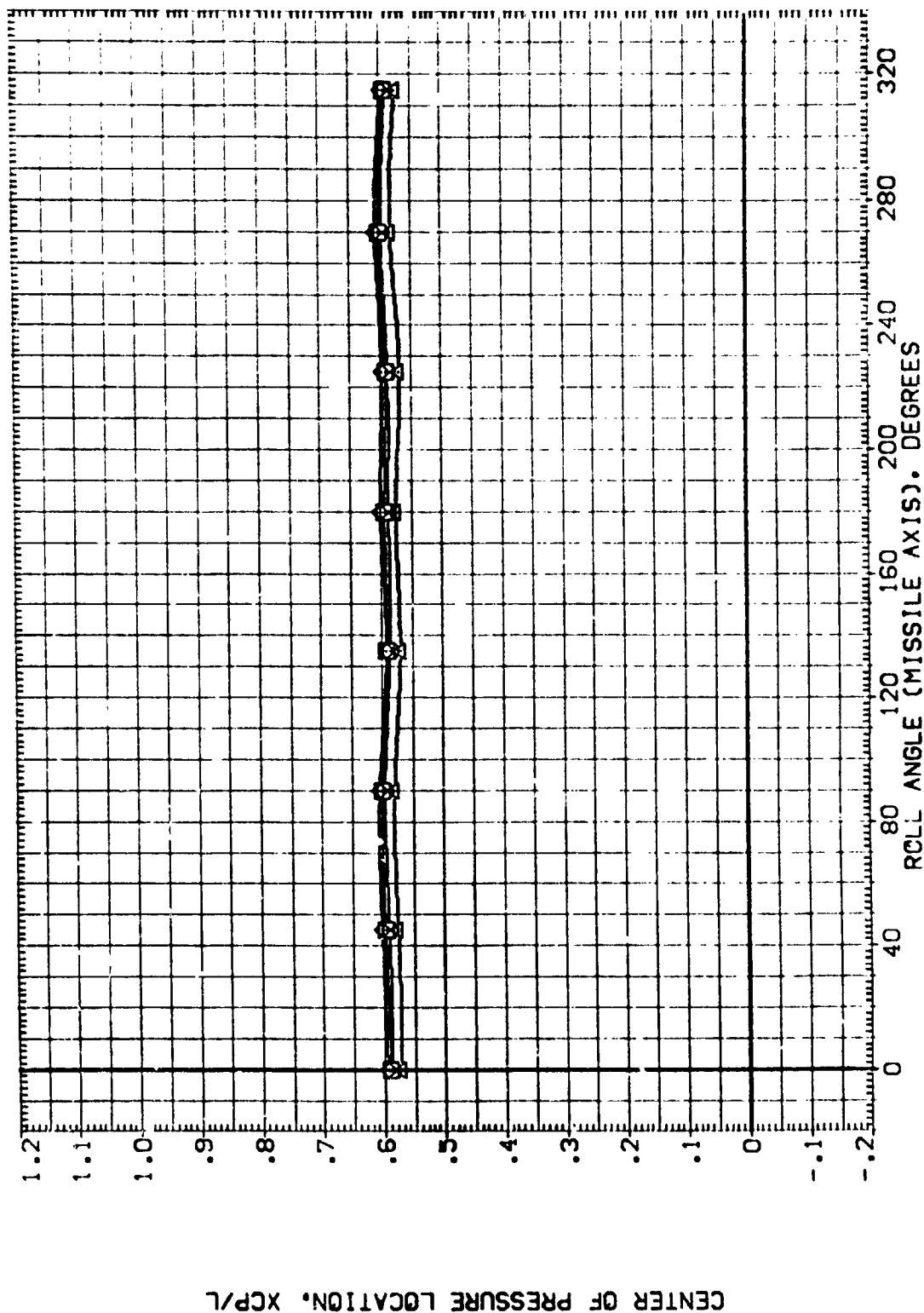
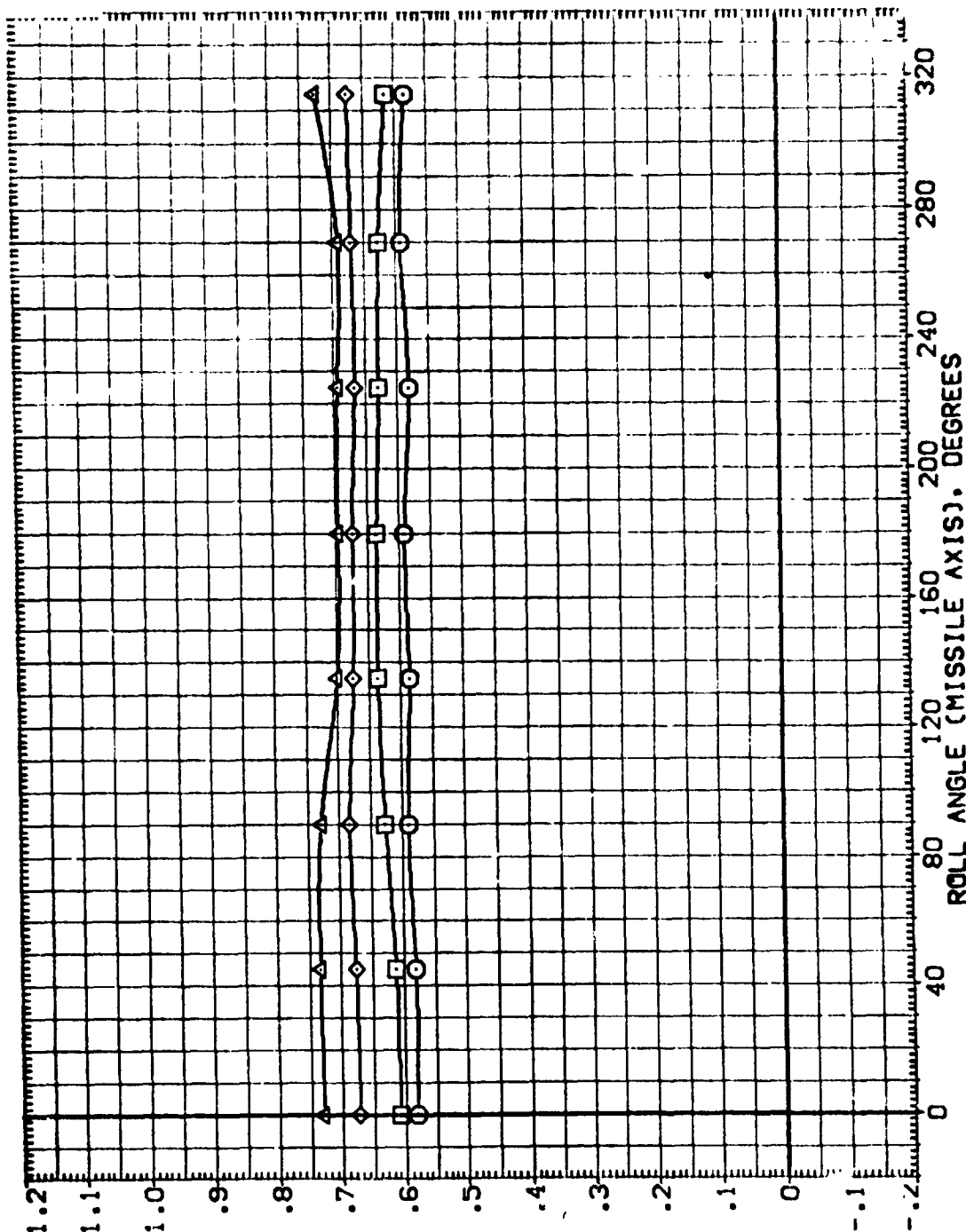


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (NEYM01)

ALPHA
 155.
 160.
 165.
 170.
 P
 10.400
 RV/L
 1.160
 REF
 F
 330.
 1406.
 TION
 50.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT
 SCALE



CENTER OF PRESSURE LOCATION, XCP/L

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (NEYMO1)

175.
 180.
 185.
 P 10.400
 TRIC V S 1.160
 SREF 594.1360
 LREF 330.
 BREF 330.
 XMR 1406.
 RENGE INF
 TION 50.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT
 SCALE : :

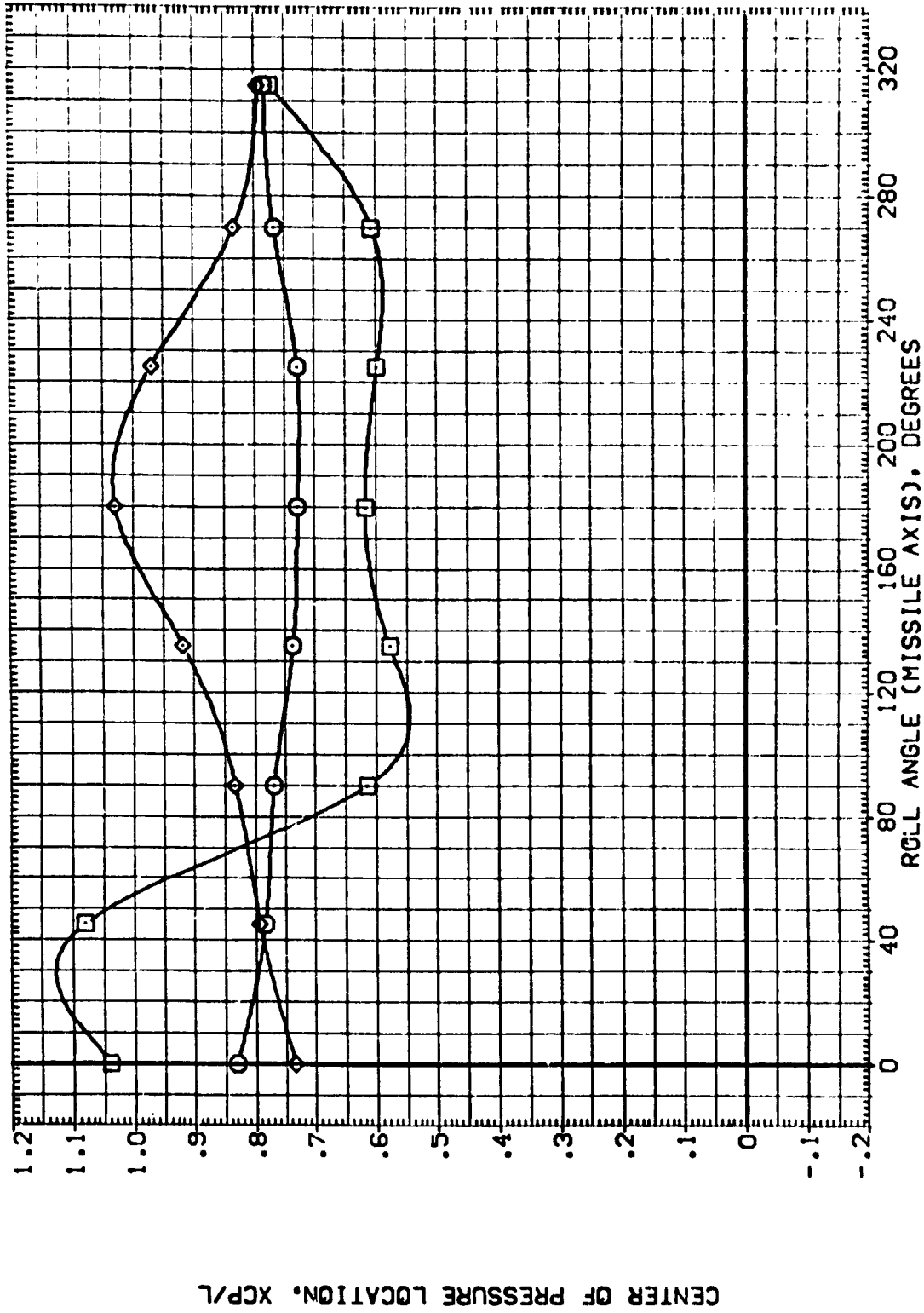
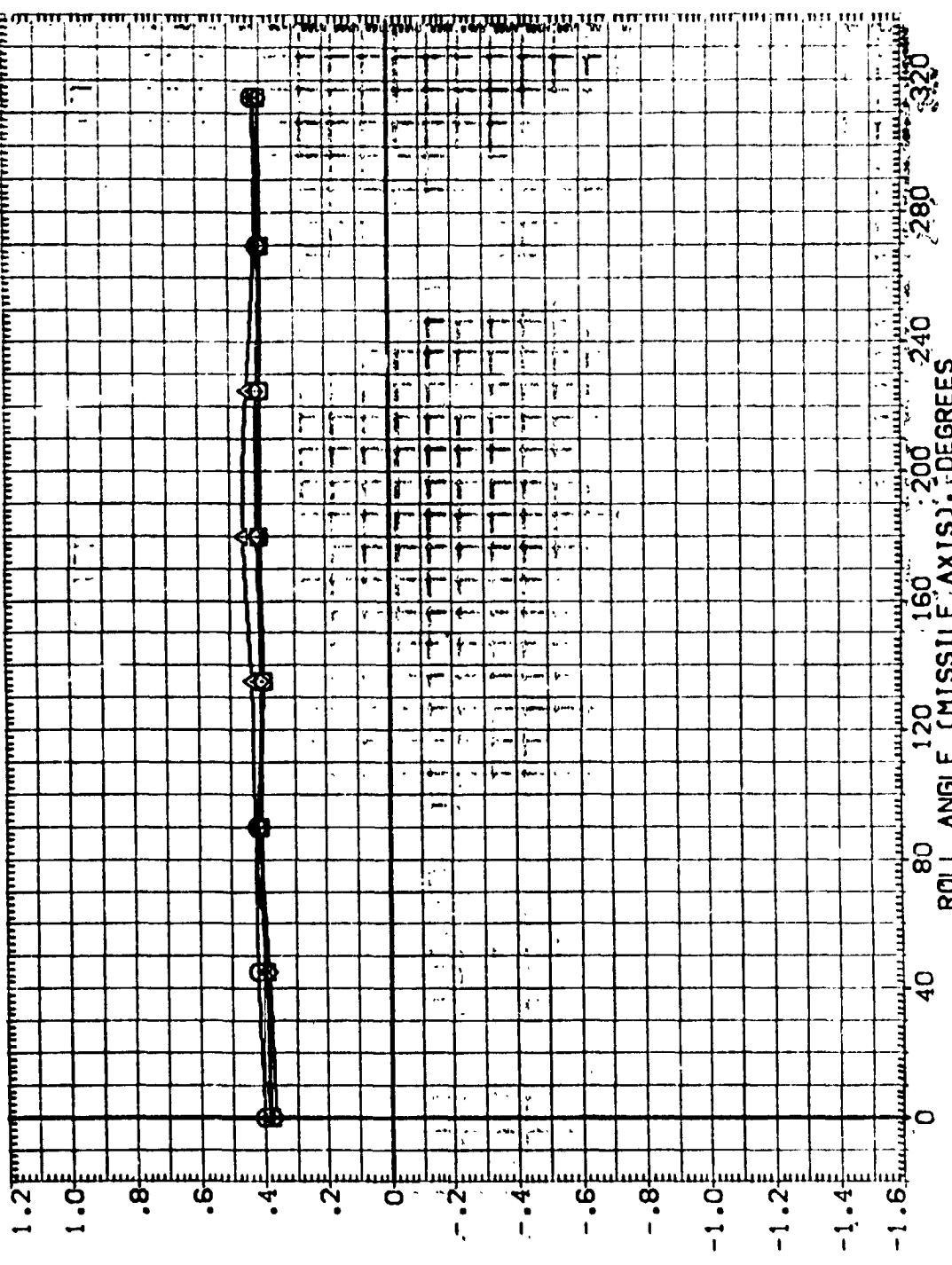


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (PEYMO1)

P 10.400 RV/L 1.160
 TRIC VALUES
 LREF 50.FT.
 BREF IN.
 XTRP IN.XT
 YTRP IN.YT
 NCE I 1406.
 SCALE . . .

-5.
 5.
 10.



FOREBODY AXIAL FORCE COEFFICIENT (MISSILE AXIS), CAF

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (PEYMO1)

15.
 20.
 25.
 30.

P TRIC VALUES
 10.400 RV/L 1.160

REFERENCE INF
 SREF 594.1
 LREF 330.
 BREF 330.
 XMRP 1406.
 YMRP :
 ZMRP :
 SCALE :

TION
 90.FT.
 IN.
 IN.
 IN.
 IN.
 IN.
 IN.

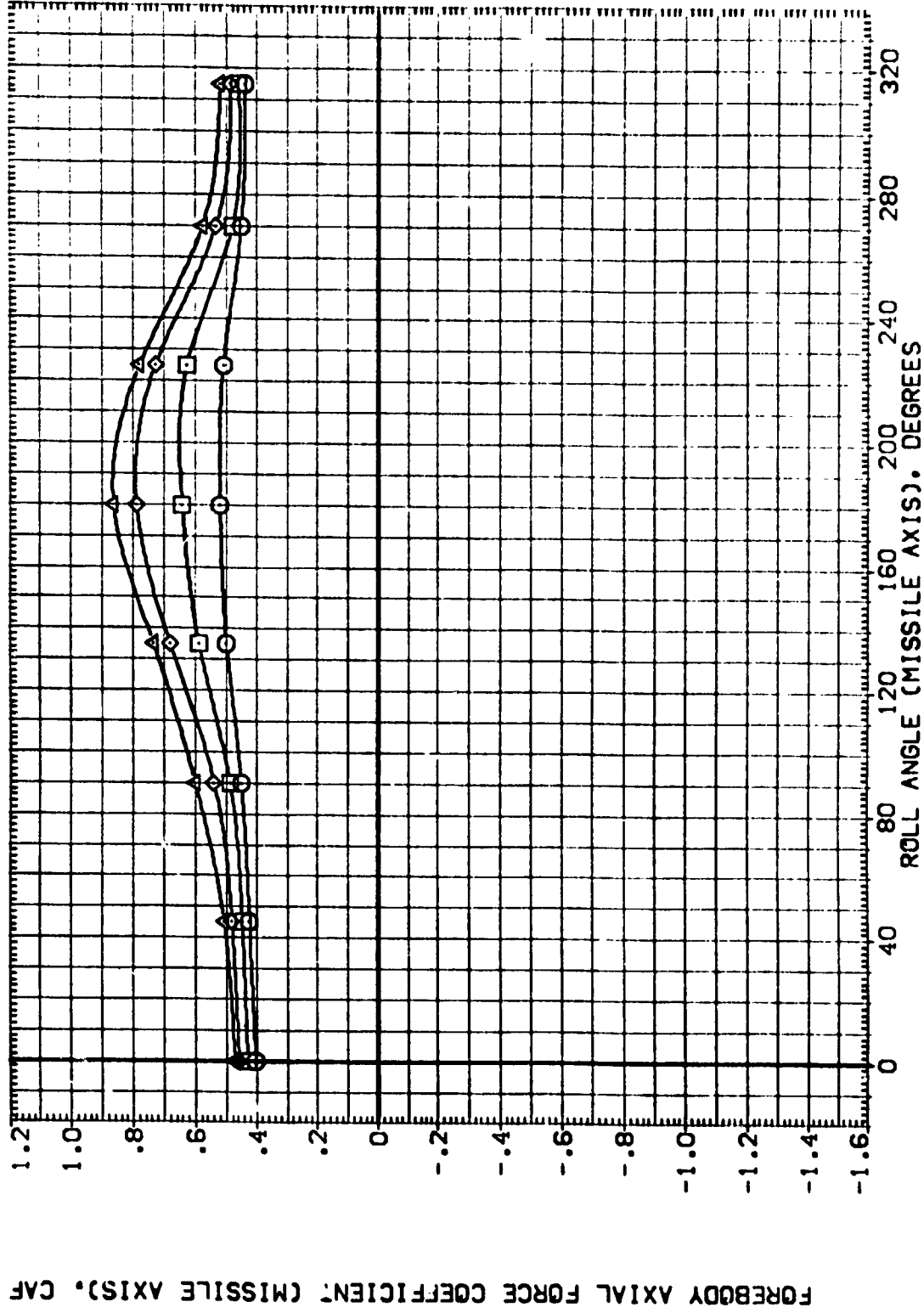


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (PEYMO1)

150. 155. 160. 165.
 O ◇ □ △
 P. TRIC VALUES 1.160
 10.
 LREF F 1406.
 REFE I
 TION SO.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT
 SCALE

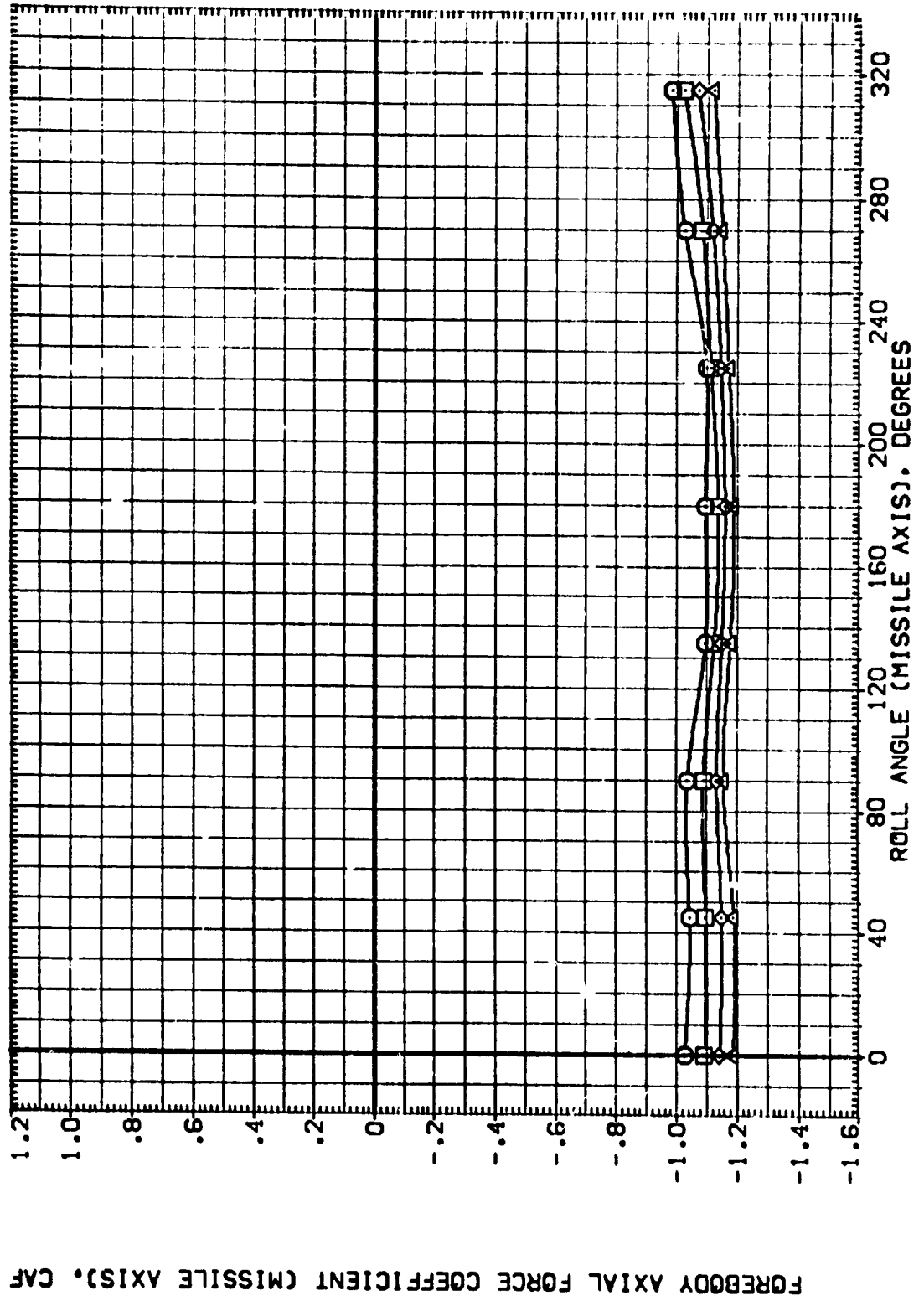
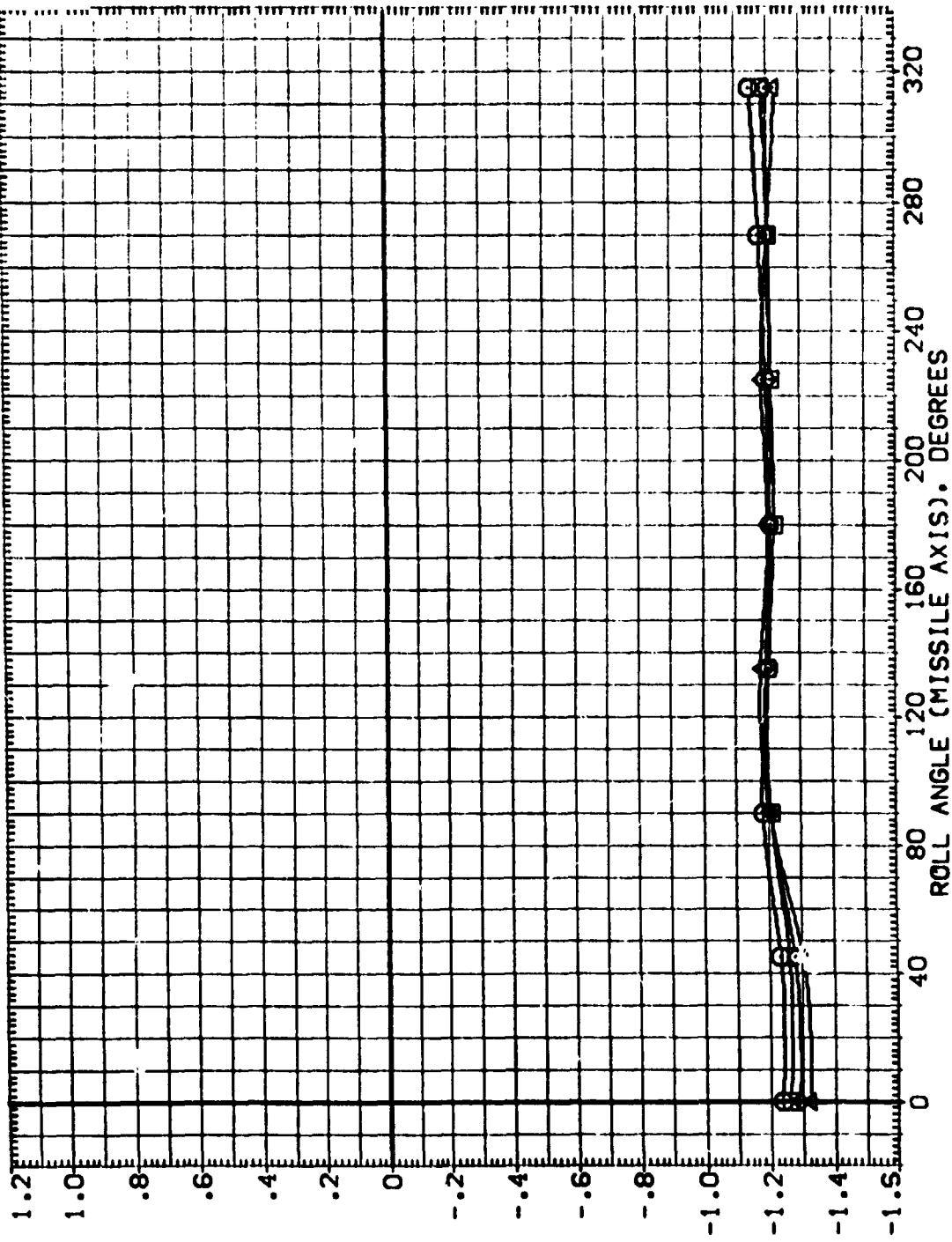


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

170.
175.
180.
185.

▷◻◻▷

P 10. IC V 1.100
LREF X I
TIDN 50.FT.
IN.
IN.XT
IN.YT
IN.ZT



FOREBODY AXIAL FORCE COEFFICIENT (MISSILE AXIS), C_{ax}

FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (PEYMO1)

-5.
 5.
 10.

P. TRIC VALUES
 10.400 1.160

REFERENCE I
 594.1
 LREF F
 1406.

TION
 50.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

SCALE

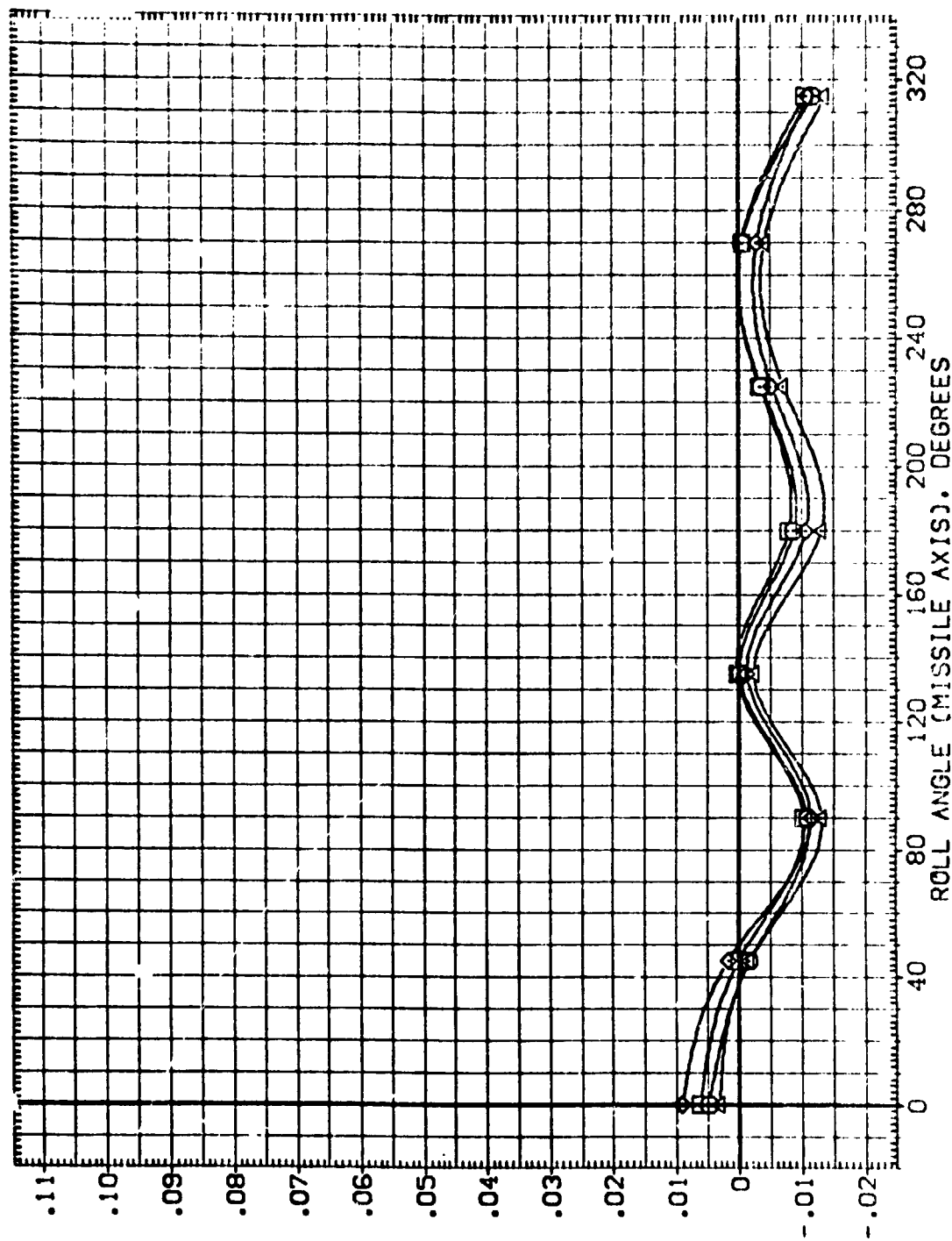


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TA9F ET (TANK WITH PROTUBERANCES) (PEYM01)

15. 10.400 RV/L 1.160
 20. 10.400 RV/L 1.160
 25. 10.400 RV/L 1.160
 30. 10.400 RV/L 1.160

PA TRIC VALUES
 10.400 RV/L 1.160

REF 594.1
 LREF 330.
 BREF 1406.

TIDN 50. FT.
 IN.
 IN.
 IN.
 IN.
 IN.
 IN.

SCALE

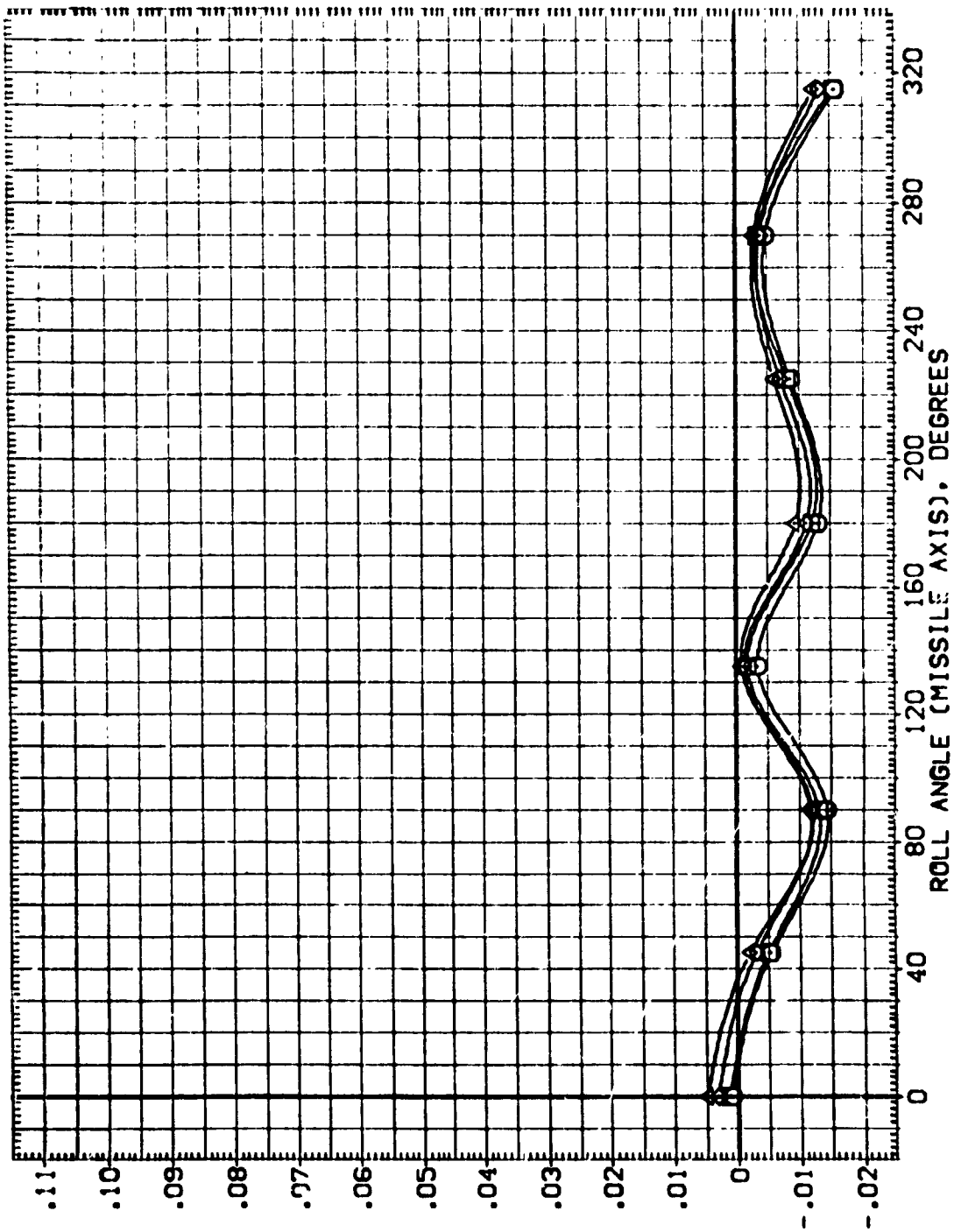


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES) (PEYMO1)

150.
155.
160.
165.

P TRIC VALUES 1.160

RECE INF TION
SQ.FT.
IN.
IN.
IN.XT
IN.YT
IN.ZT

SPREF
LREF
BREF
YMRP
SCALE

330.
330.
1406.
.
.

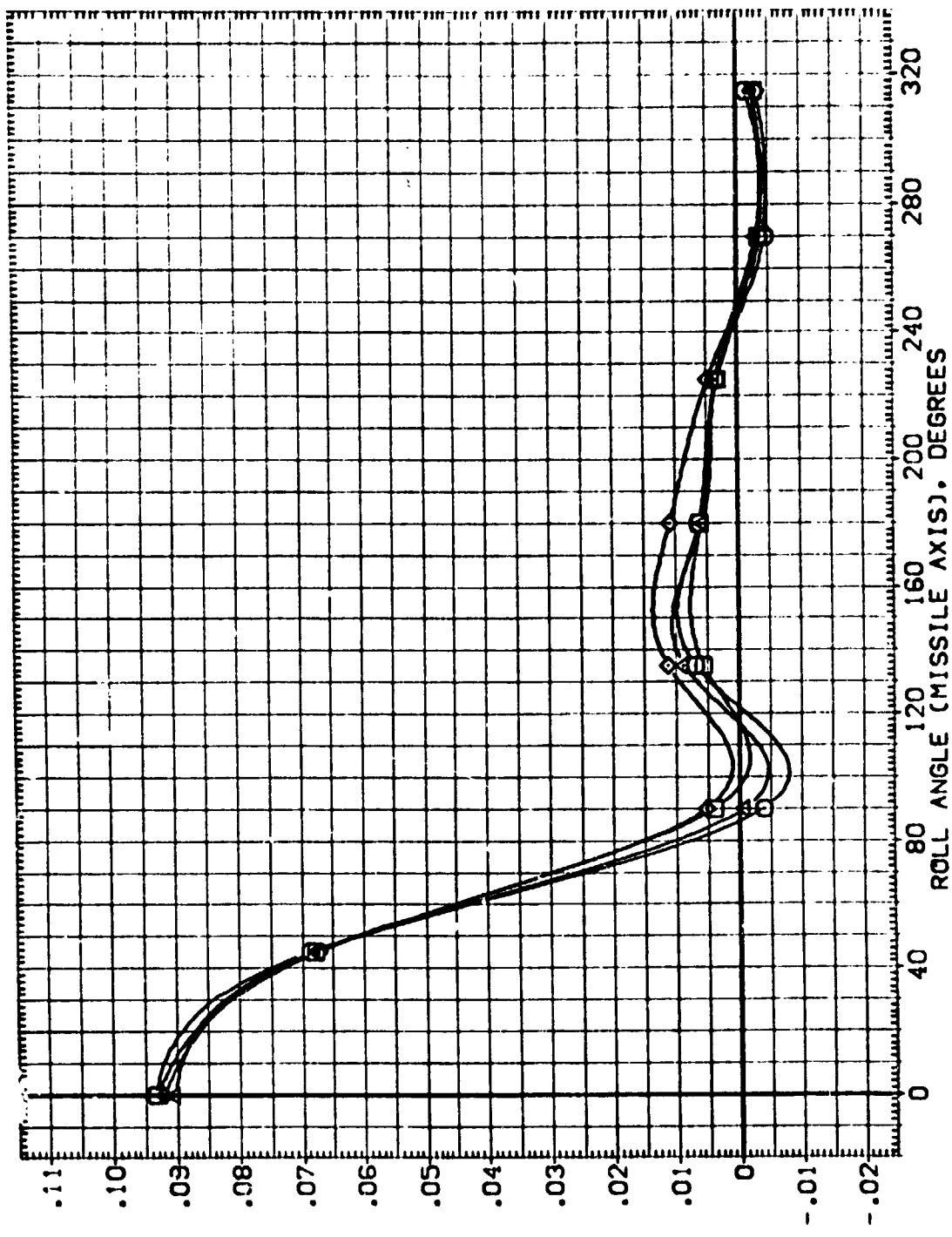


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

A 3.5-156 TA9F ET (TANK WITH PROTUBERANCES) (PEYMO1)

170. 10. TRIC V S 1.160 TION 50.FT.
 175. 10. TRIC V S 1.160 TION 50.FT.
 180. 10. TRIC V S 1.160 TION 50.FT.
 185. 10. TRIC V S 1.160 TION 50.FT.
 LREF 330. IN. IN. XT
 BREF 1406. IN. IN. XT
 XREF . . IN. XT
 SCALE . . IN. XT

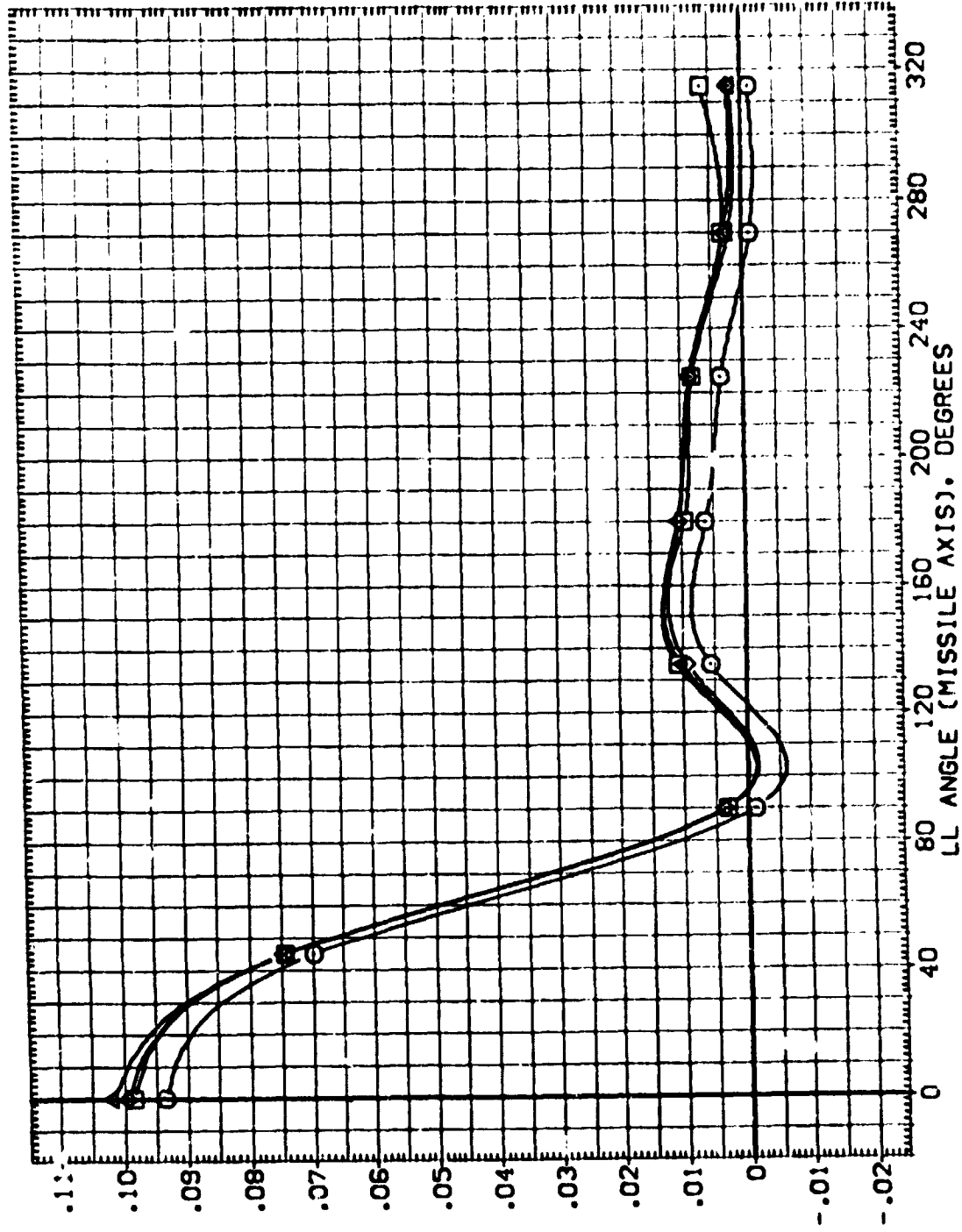


FIG. 9 COEFFICIENTS VERSUS ANGLE OF ROLL

DATA SET
 (DEMO1)
 (CE)

ARC 3.5-136
 3.5-136
 TANK WITH
 TANK ET (IC TANK)

TION DE
 TION DE
 TION DE

INF ATION
 594.1360
 594.1360
 1406:
 IN. XT
 IN. YT
 IN. ZT

SREF
 LREF
 F

10.400 1:160
 10.400 1:160

SCALE
 :
 :
 :

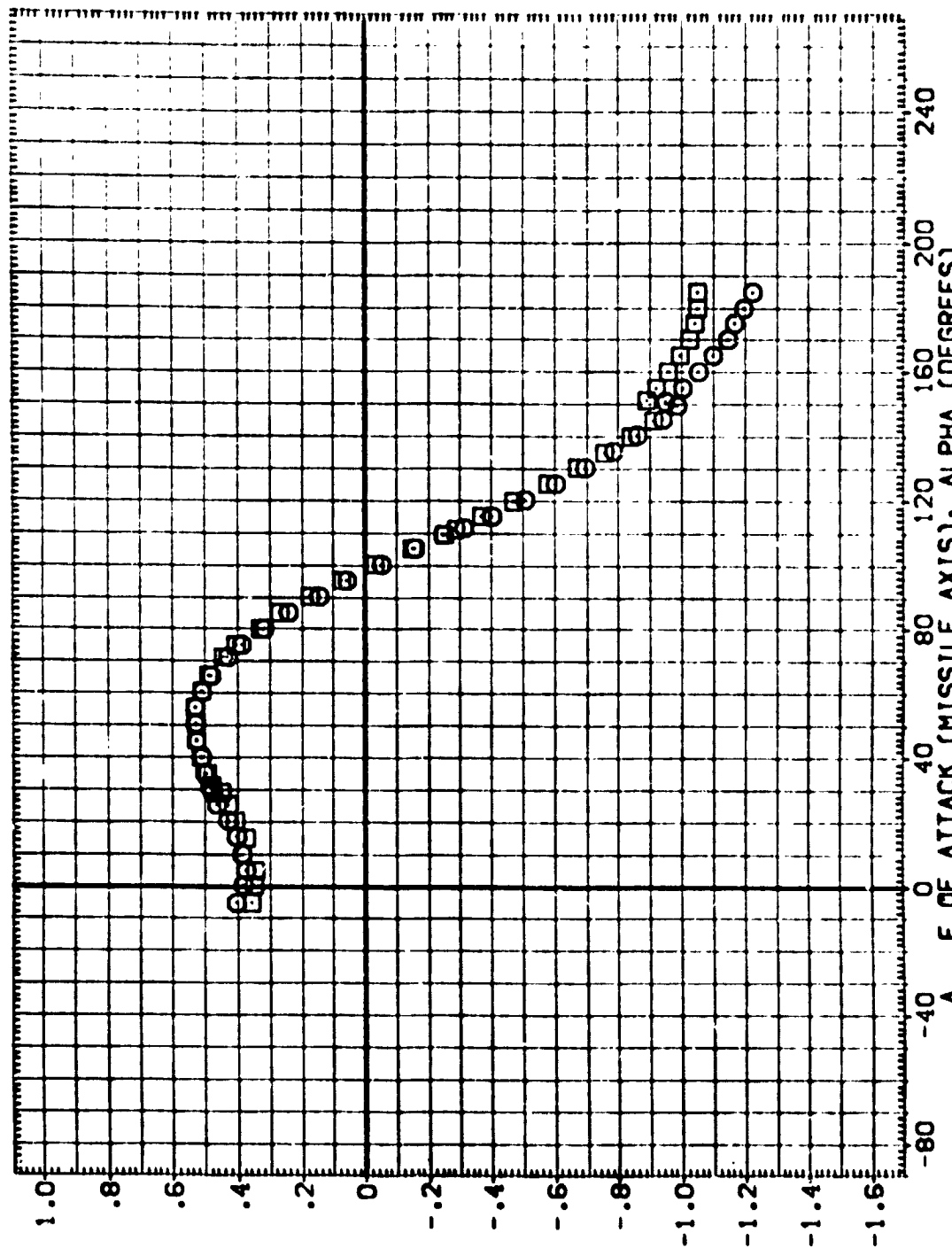


FIG. 10 BASIC TANK VERSUS TANK WITH PROTUBERANCES

(A)PHI = .00

PRECEDING PAGE BLANK

DATA SET (DEVELOP) 8

ARC 3.5-196 TAS ET (TANK WITH PROTUBERENCES)

ARC 3.5-196 TAS ET (BASIC TANK)

1 TION DE IPTION

10:4

RVAL 1:160 1:160

REFE 1

1406

1

90.FT.

IN.

IN.XT

IN.YT

IN.ZT

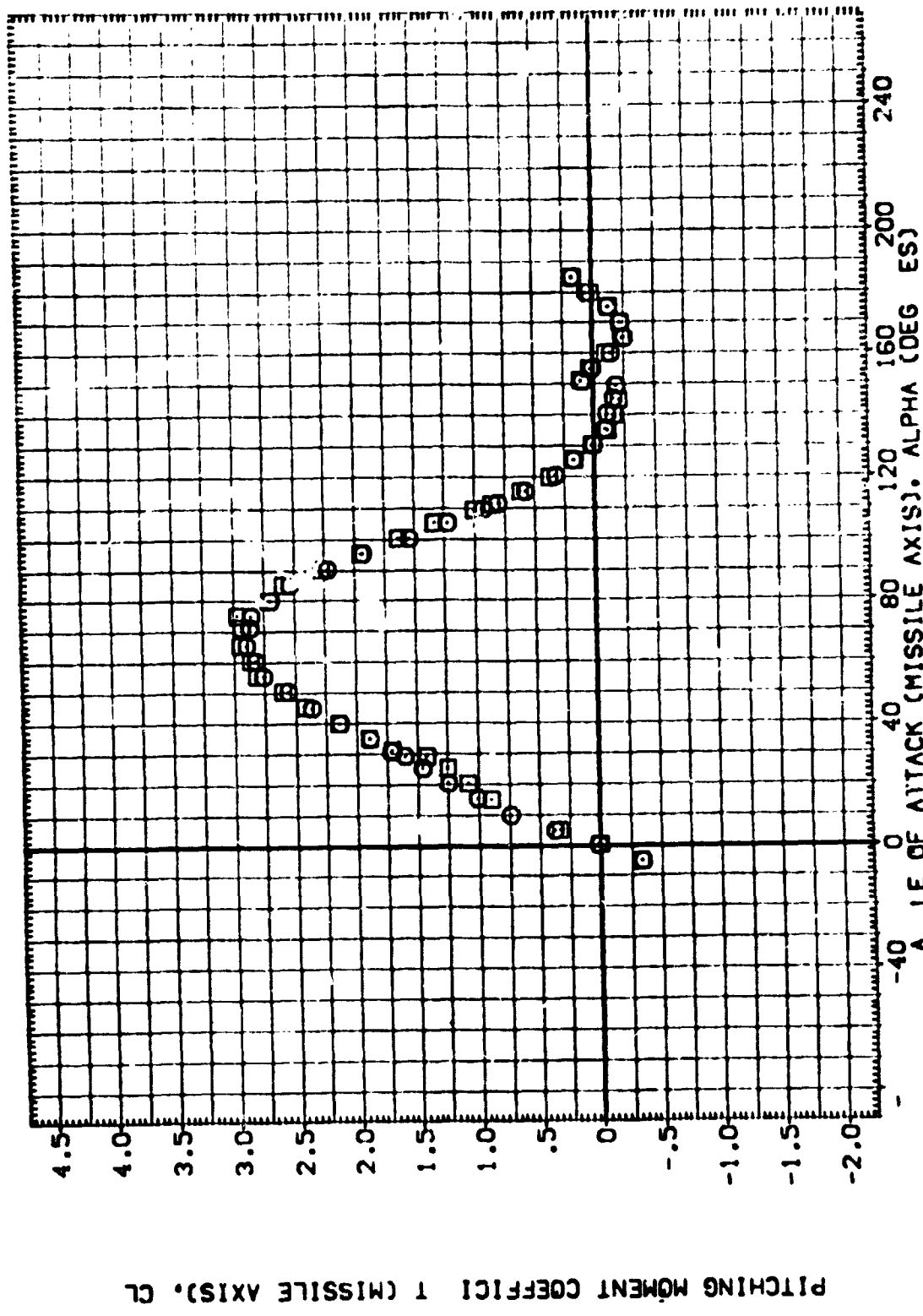


FIG. 10 BASIC TA VERSUS TANK WITH PROTUBERENCES

(A)PHI = .00

DATA SET
(CEYNDI)
(CE)

ARC 3.5-196 Y
ARC 3.5-196 Y

PTION
ET (TANK WITH
ET (IC TANK)

MACH
10.400
10.400

REF
330.
1405.

INF
.1
330.
1405.

TION
50.FT.
IN.
IN.XT
IN.XT
IN.XT

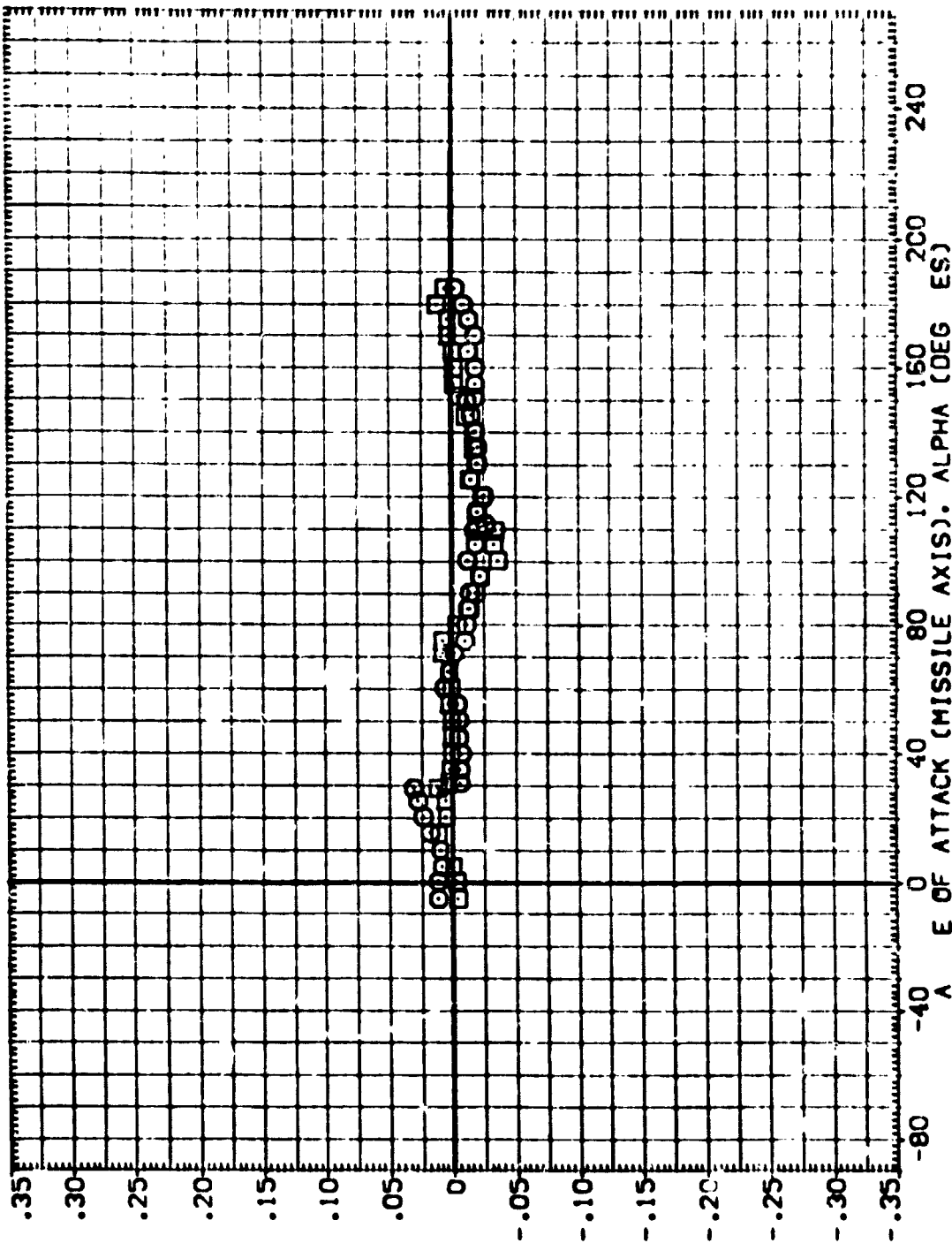


FIG. 10 BASIC TANK WITH PROTUBERANCES

(A) $\alpha = .00$

DATA SET
(CE 1) 8

3.5-196 TASF ET (TANK WITH T) S) 10.400 1:160
ARC 3.5-196 TASF ET (BASIC TANK)

REFE 594.1
LREF 300.
BREF 330.
1406.

TION INF TION
50.FT.
IN.
IN.XT
IN.YT
IN.ZT

SCALE

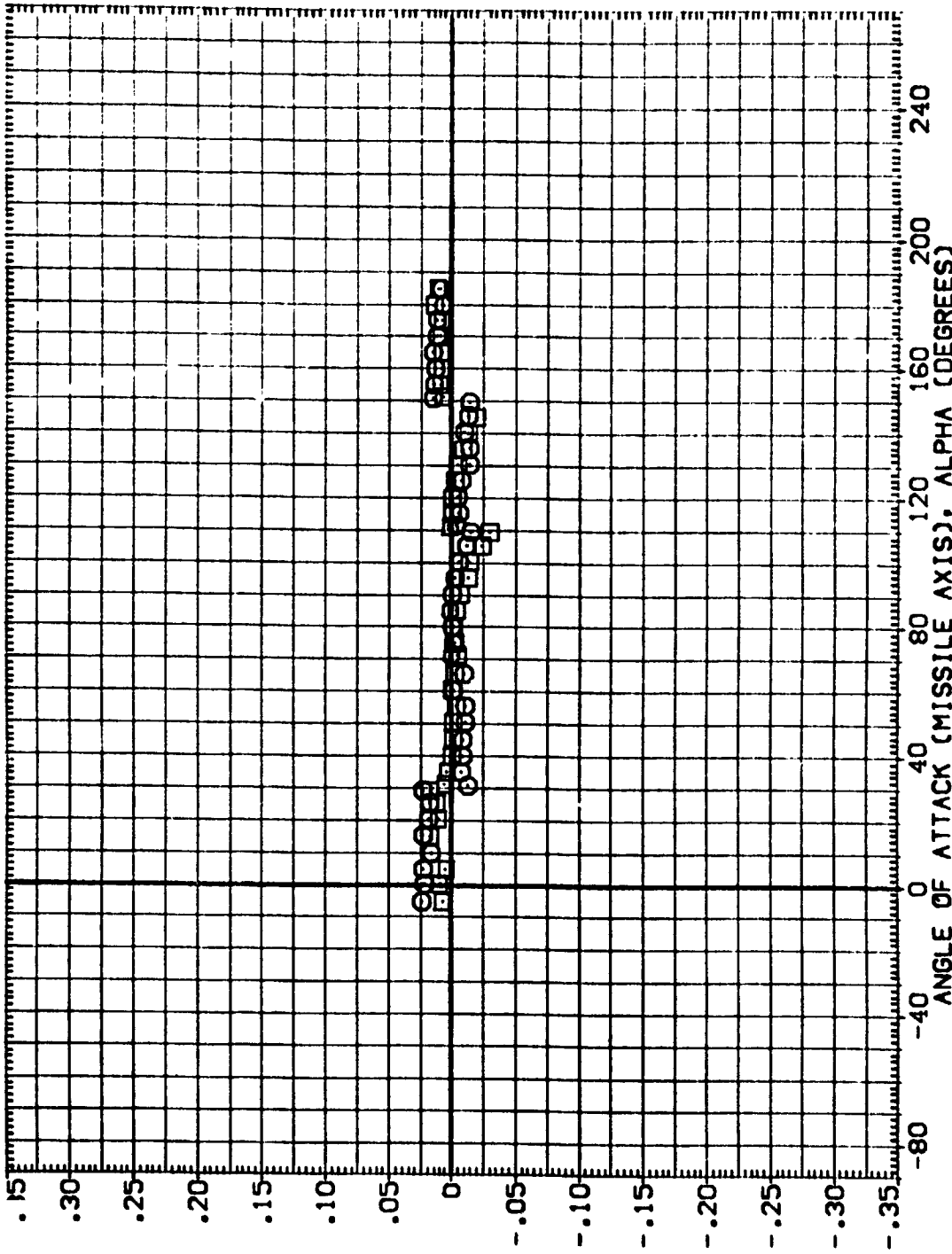


FIG. 10 BASIC TANK VERSUS TANK WITH PROTUBERENCES

(A)PHI = .00

DATA SET
 {CE 1}
 TION
 ARC 3.5-196 TASF ET (TANK WITH
 ARC 3.5-196 TASF ET (IC TANK)
 REF
 SREF 594.1
 LREF 330.
 BREF 1406.
 TION
 50.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

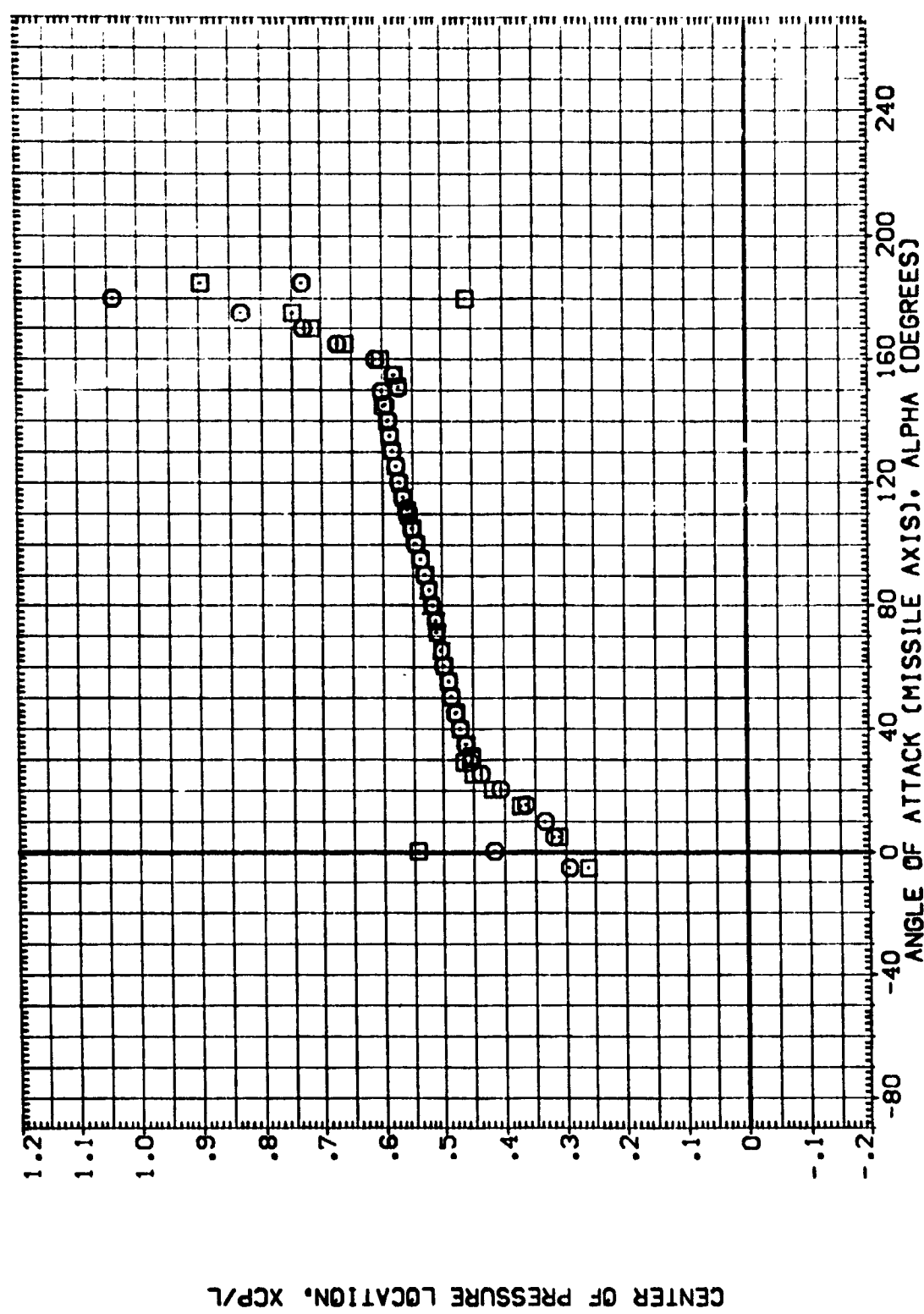


FIG. 10 BASIC TANK VERSUS TANK WITH PROTUBERENCES

(A)PHI = .00

DATA 1 }
 {
 TION
 3.5-196 T ET (TANK WITH
 3.5-196 TASF ET (IC TANK)
 10. 10. 1.160 1.160
 1406. 1406.
 90.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

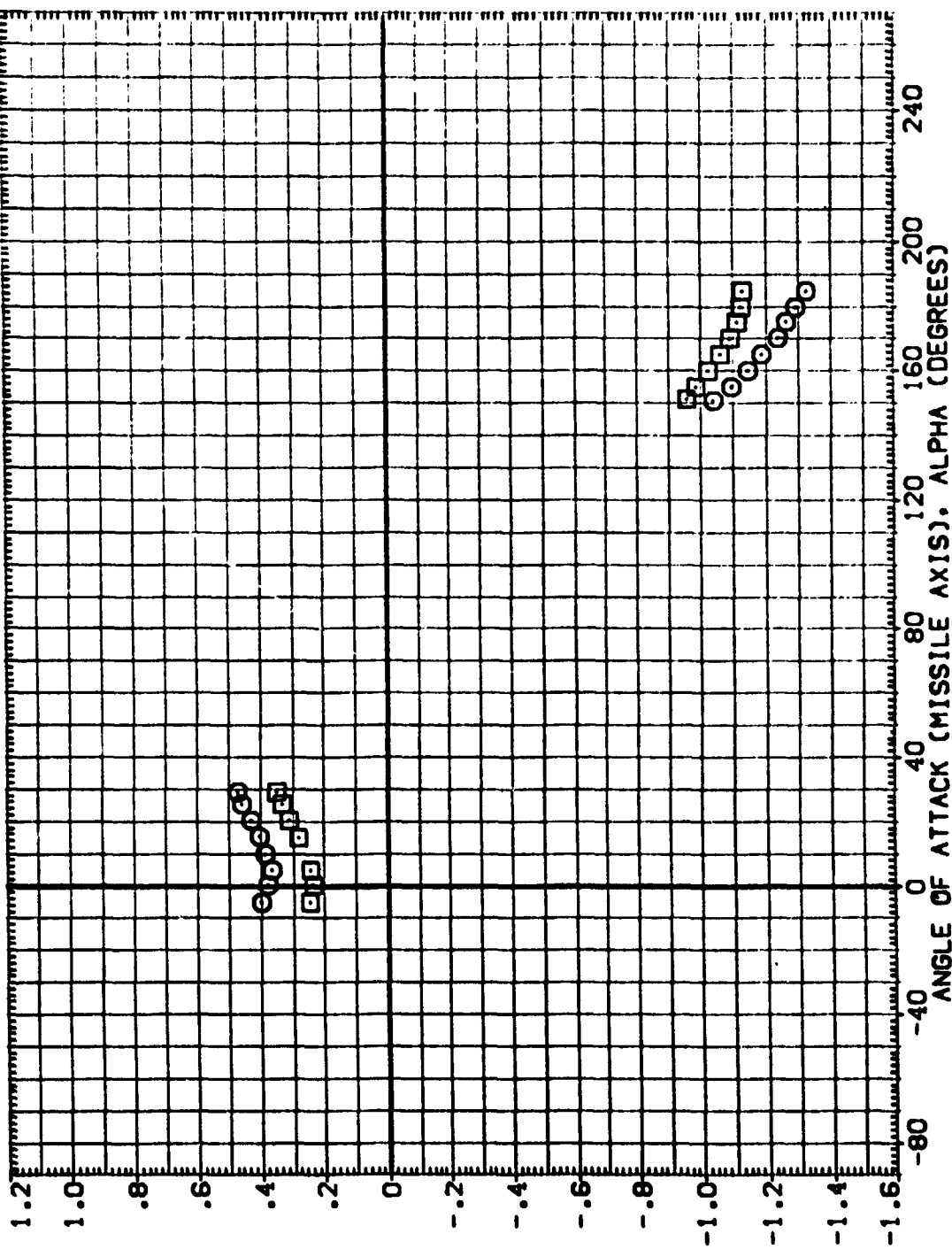
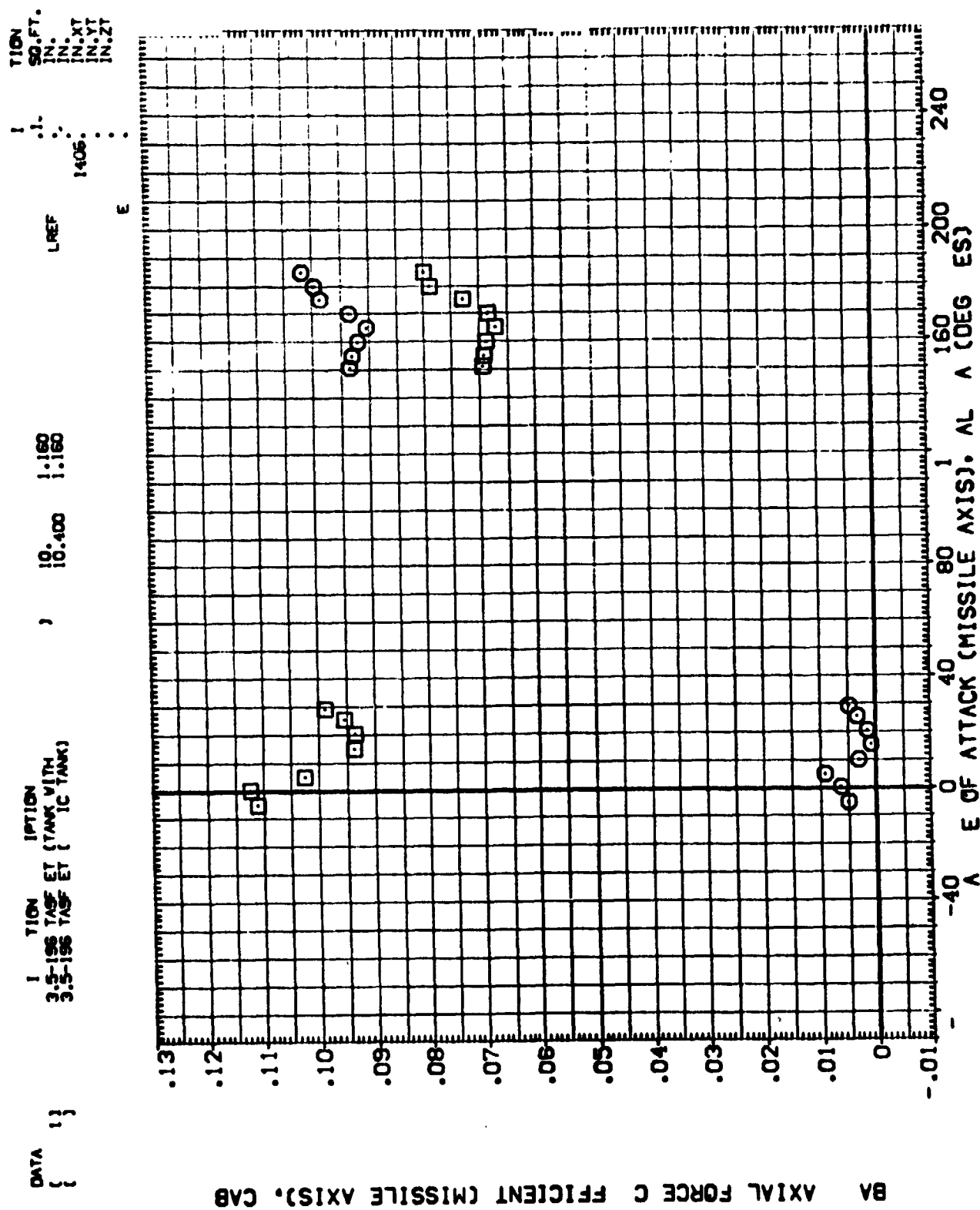


FIG. 10 BASIC TANK VE US TANK WITH PROTUBERENCES

(A)PHI = .00



ARC 3.5-1 TAGF ET (TANK WITH PROTUBERANCES) (LEYMO1)

ION
SQ.FT.
IN.
IN.XT
IN.YT
IN.ZT

1

.1

LREF

1406

SCALE

1.160

IC V

10.

PHI

O

INCREMENTAL NORMAL-FORCE COEFFICIENT (MISSILE AXIS), C_N

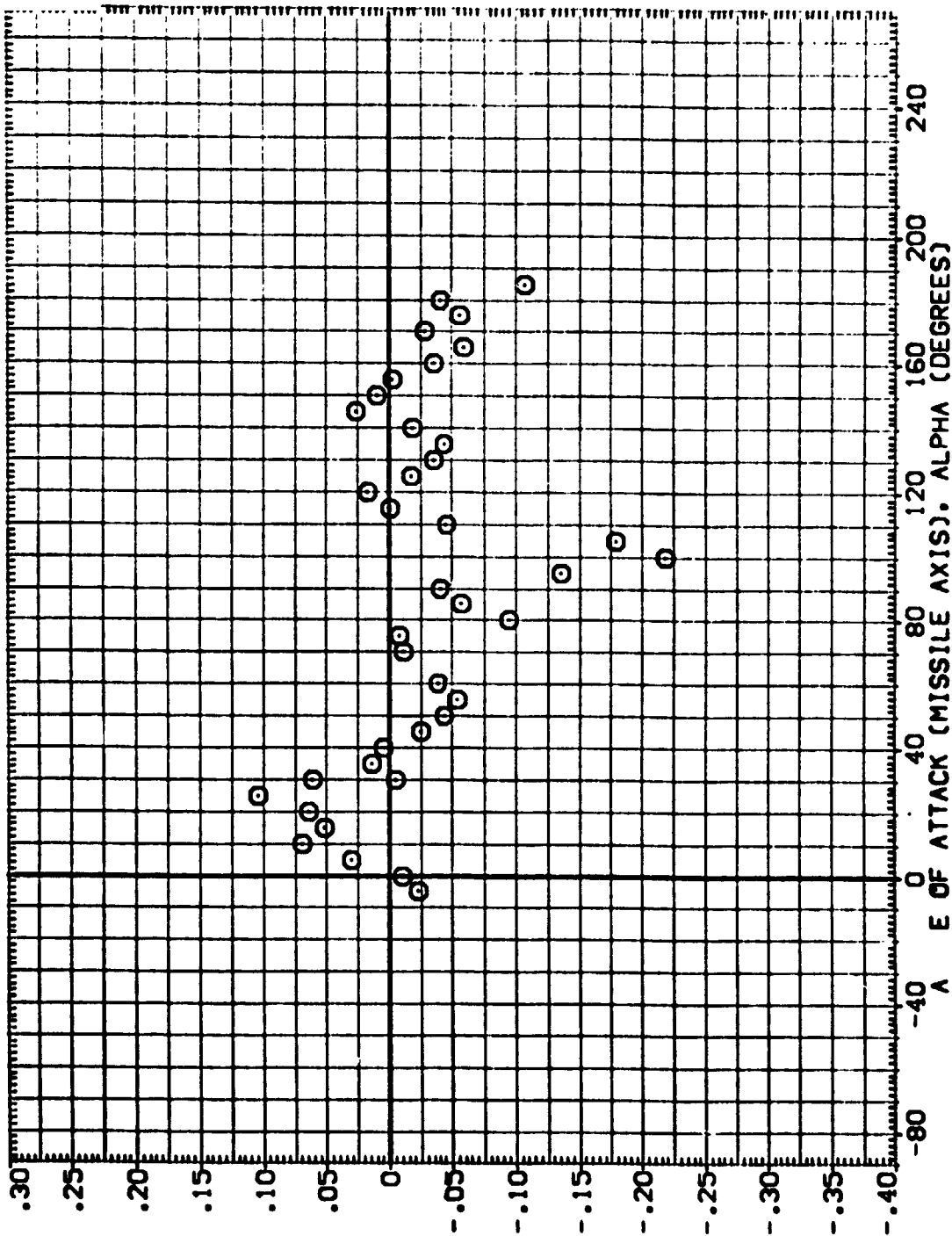


FIG. 10 BASIC TA VERSUS TA WITH PROTU RENCES

(104Y37)

P	TRIC VALUES
10.400	1.160
F	.1
LREF	330
BREF	1406
XMRP	.
YMRP	.
SCALE	.
TION	I
SQ.FT.	IN.
IN.	IN.XT
IN.	IN.YT
IN.	IN.ZT

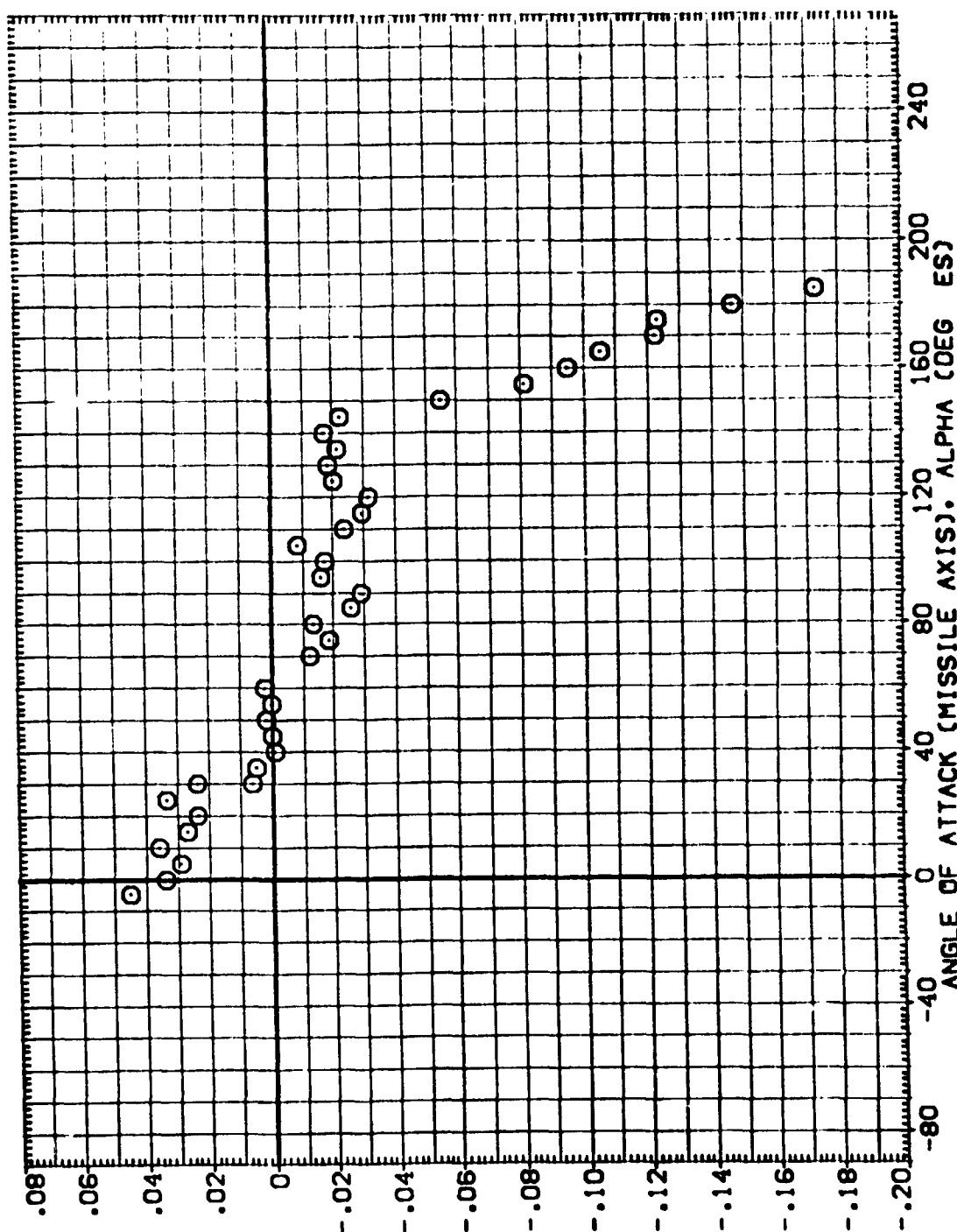


FIG. 10 BASIC TANK VE US TANK WITH PROTUBERENCES

PHI	TRIC V	INF	TION
0	10.400	1.160	SO.FT.
.			IN.
			IN.
			IN.XT
			IN.YT
			IN.ZT
			SCALE

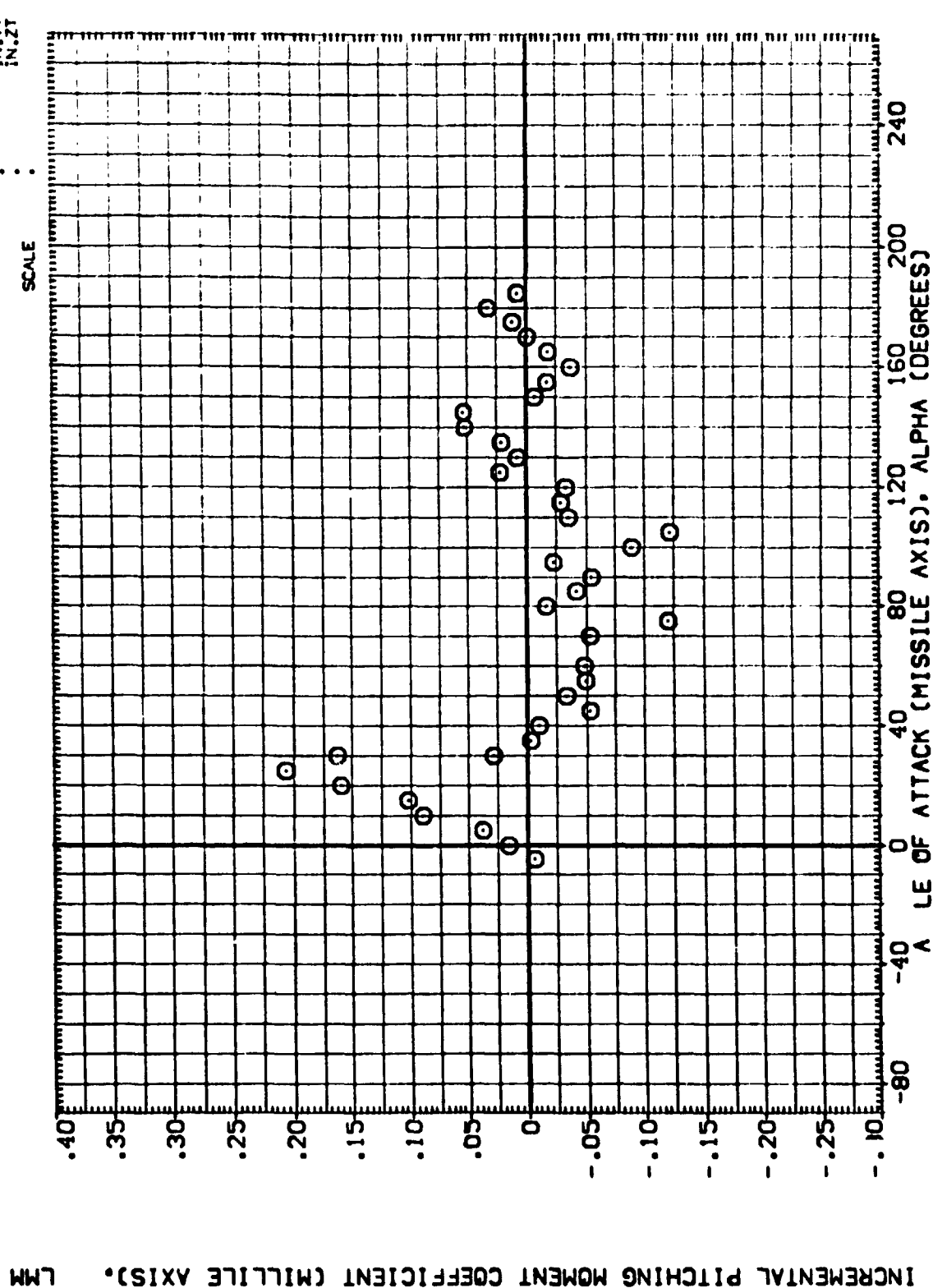


FIG. 10 BASIC TANK VE US TANK WITH PROTUBERENCES

ARC 3.5-196 TAGF ET (TANK WITH P TUBERANCES) (LEYM01)

O
 PM
 10.
 IC V
 1.180
 LREF
 1406.
 SCALE
 TION
 90.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

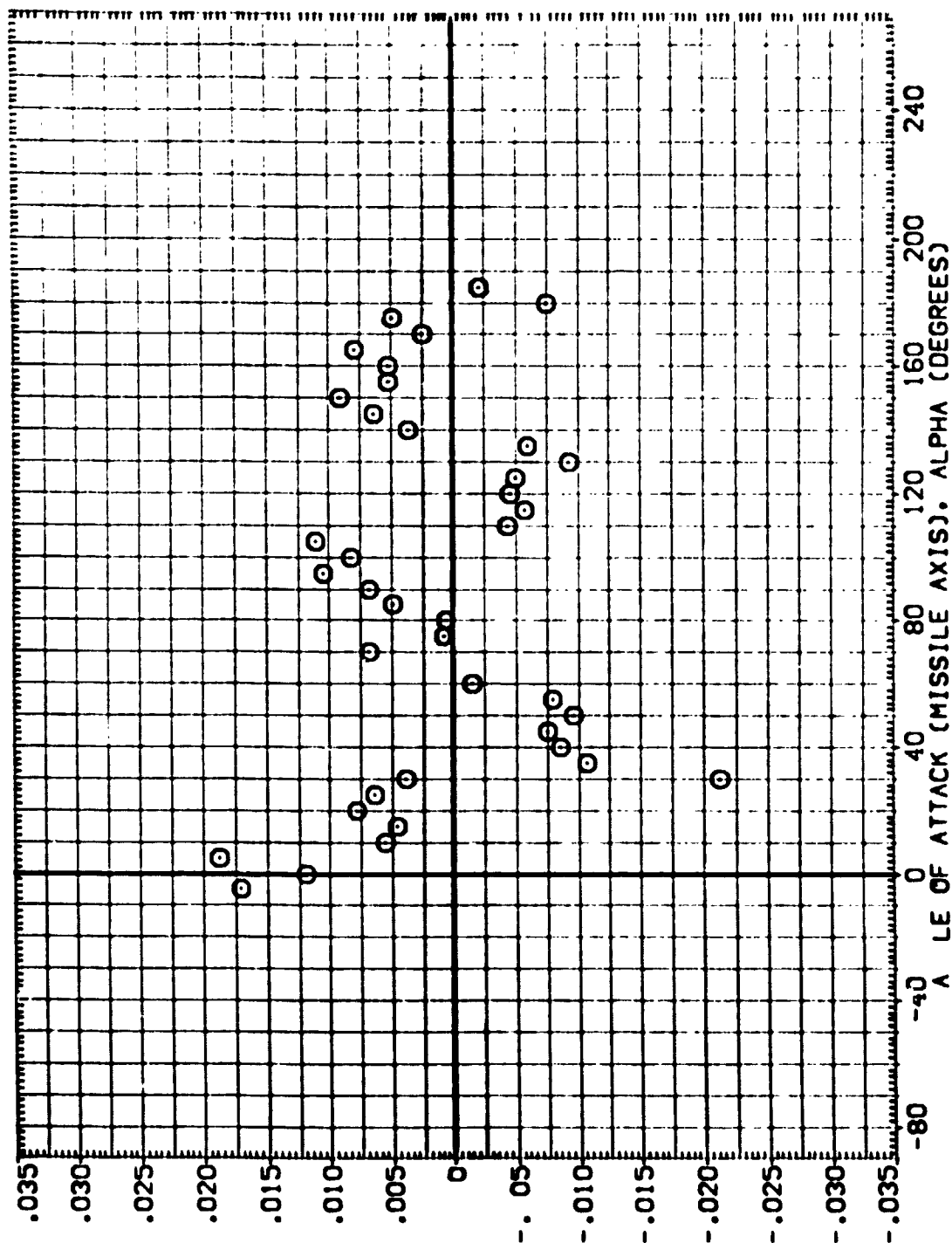


FIG. 10 BASIC TANK VE TANK WITH P TUBE NCES

[illegible]

A 3.5-196 TAGF ET (TANK WITH OTUBERANCES) (MEY 1)

PHI . TRIC V S 1.180 TION 90.FT. IN. IN.XT IN.YT IN.ZT

INCREMENTAL BASE AXIAL FO E COEFFICIENT (MISSILE AXIS). DCAB

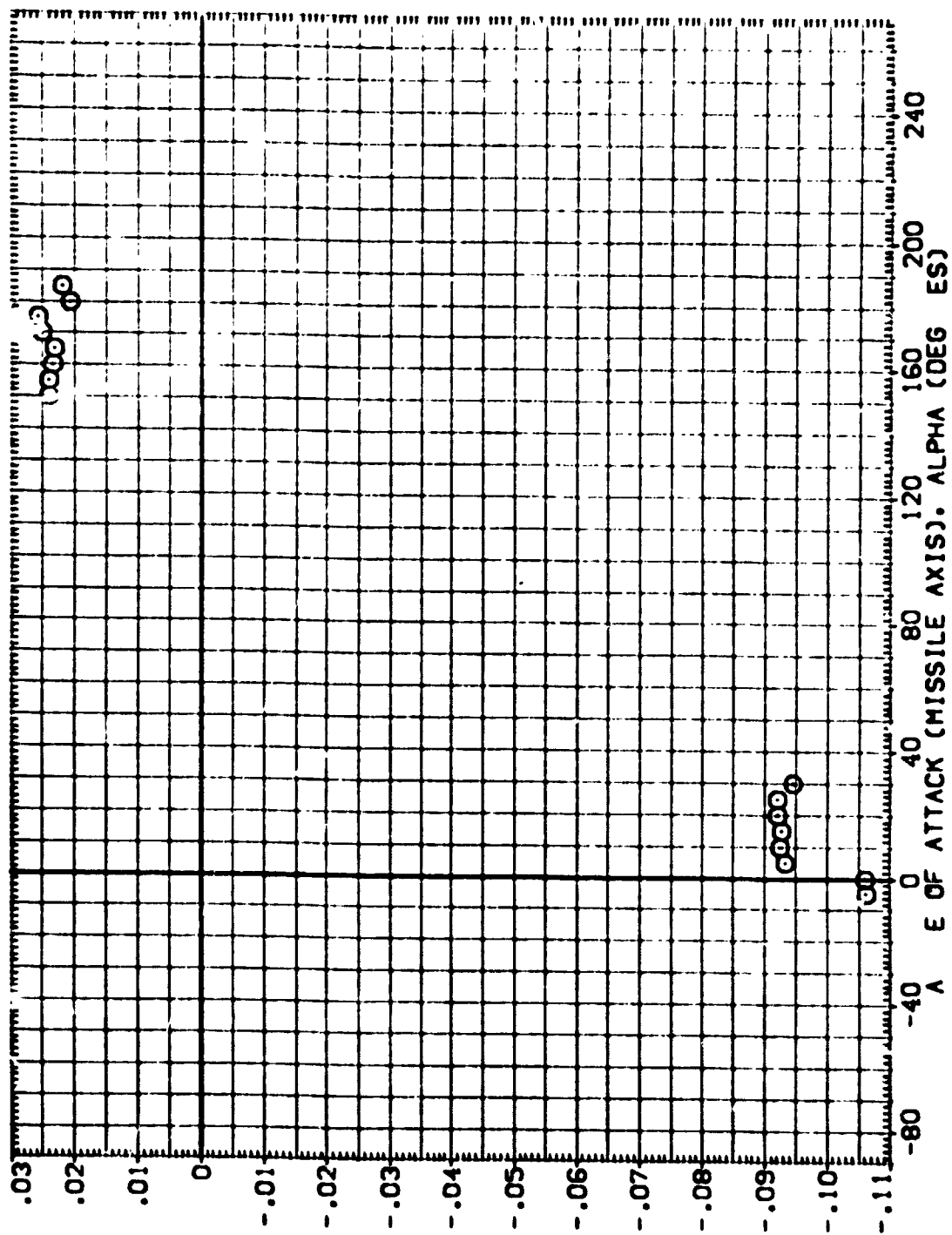


FIG. 10 BASIC T/ VE US TANK WITH P. TU NCES

DATA SET
 (CE)
 (WEYMOI)

CONFIGURATION DESCRIPTION:
 ARC 3.5-156 TASF ET (BASIC TANK)
 ARC 3.5-156 TASF ET (TANK WITH

MACH
 10.400
 10.400

RN/L
 1.160
 1.160

REFERENCE INF
 SREF 594.1360
 LREF 330.2000
 BREF 330.2000
 XMRP 1406.
 YMRP .
 IN.XT
 IN.YT
 IN.ZT

SCALE
 .
 .
 .

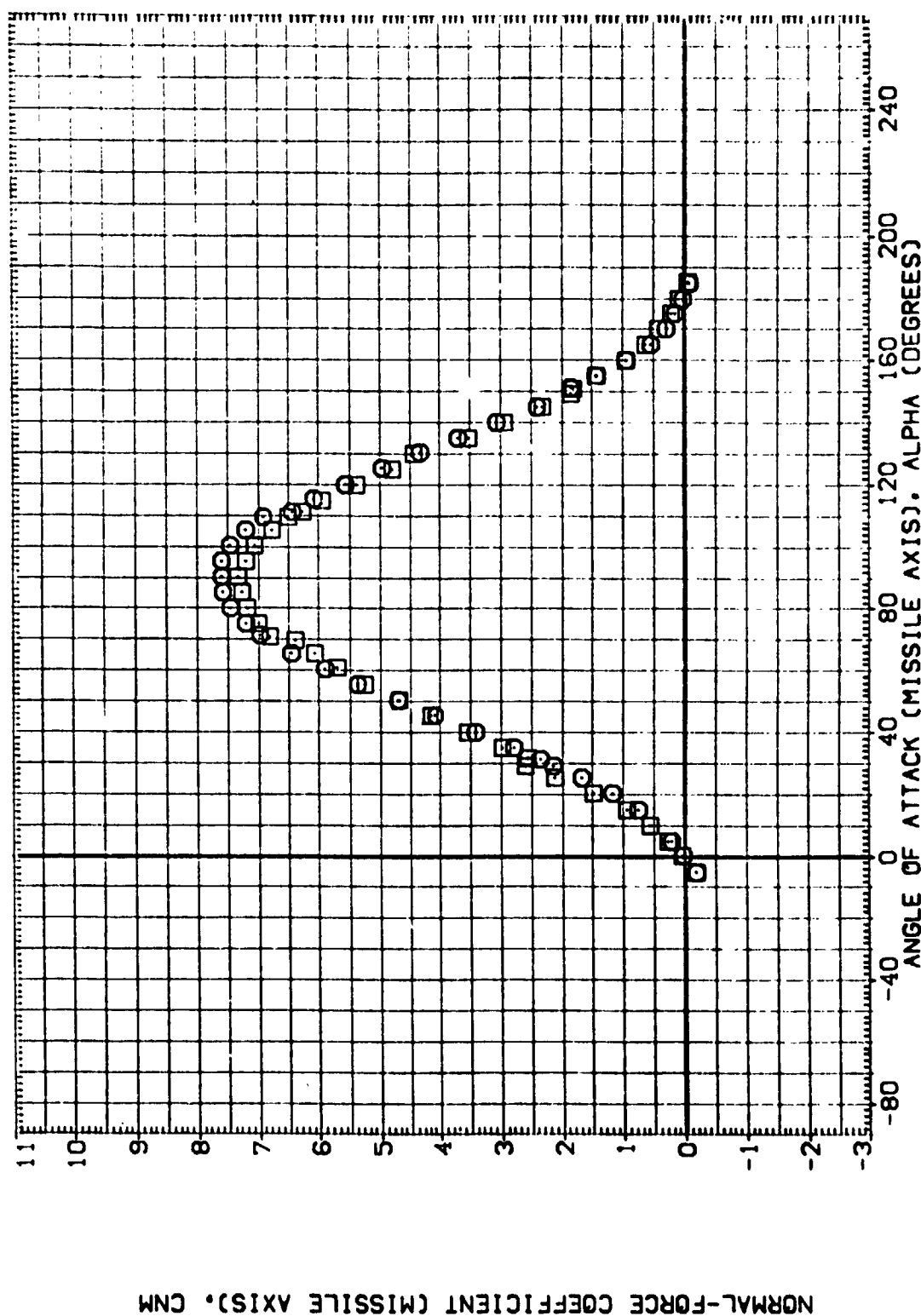
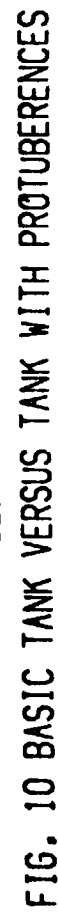


FIG. 10 BASIC TANK VERSUS TANK WITH PROTUBERANCES

(A)PHI = .00 (B)180.00

SCALES



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DATA SET
 (CE)
 (KEYMOI)
 I TION DE IPTION
 ARC 3.5-196 TASF ET (BASIC TANK)
 ARC 3.5-196 TASF ET (TANK WITH
 MACH 10.400 1.160
 10.400 1.160
 USER S)
 REFERENCE INF
 SREF 594.1360
 LREF 330.
 BREF 330.
 XMRP 1408.
 YMRP .
 ZMRP .
 SCALE .
 TION
 50.FT.
 IN.
 IN.
 IN.XT
 IN.YT
 IN.ZT

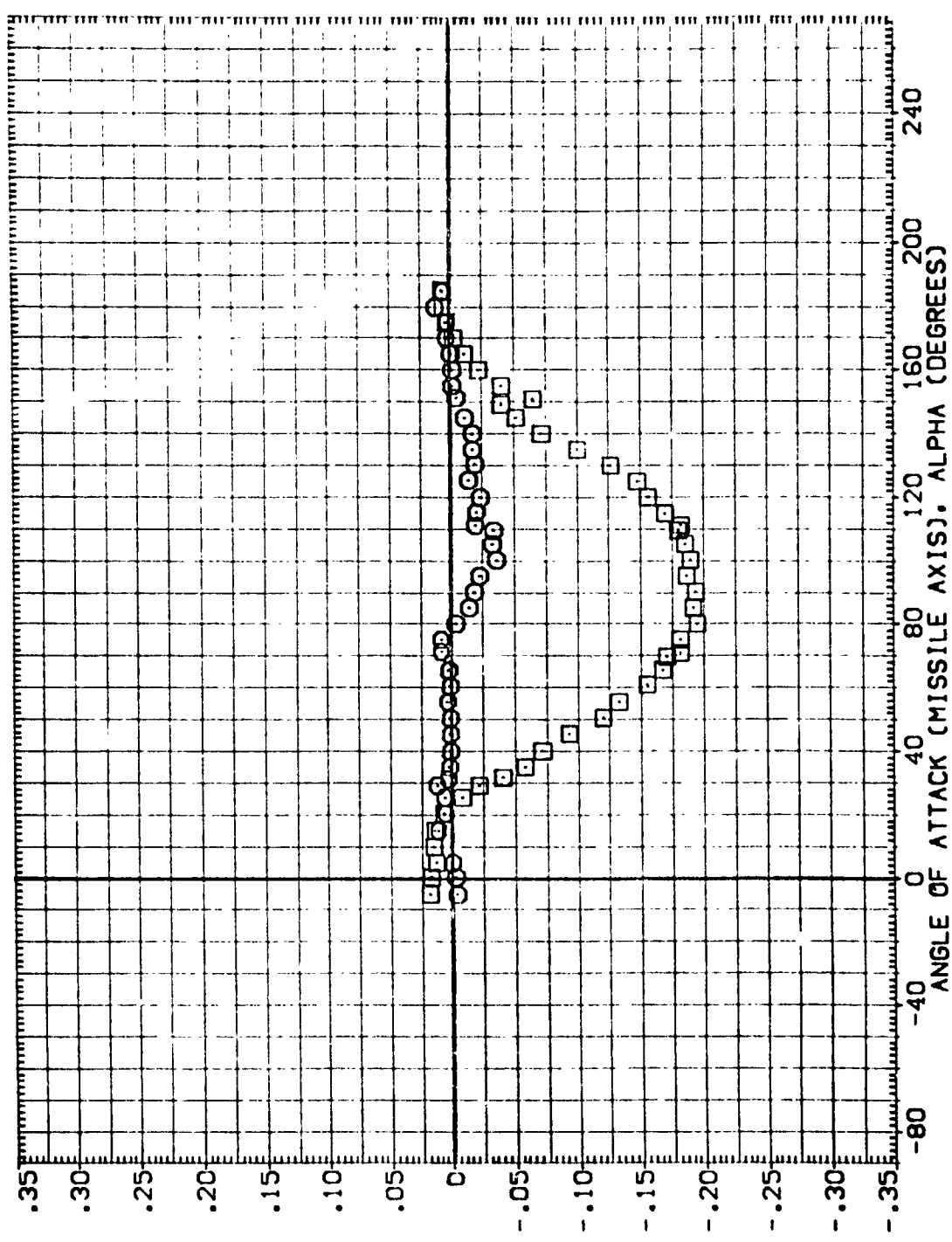


FIG. 10 BASIC TANK VERSUS TANK WITH PROTUBERENCES

(A)PHI = .00 (B)180.00

DATA SET

{CE 1}

1

3.5-198 TANK

ARC 3.5-198 TANK

ITION

ET (IC TANK)

ET (TANK WITH

MACH

10.400

10.400

RN/L

1.160

1.160

REFE

F

LREF

INF

594.1

300.

300.

1406.

TION

50.FT.

IN.

IN.

IN.

IN.

IN.

SCALE

.

.

YAWING MOMENT COEFFICIENT (MISSILE AXIS), CY

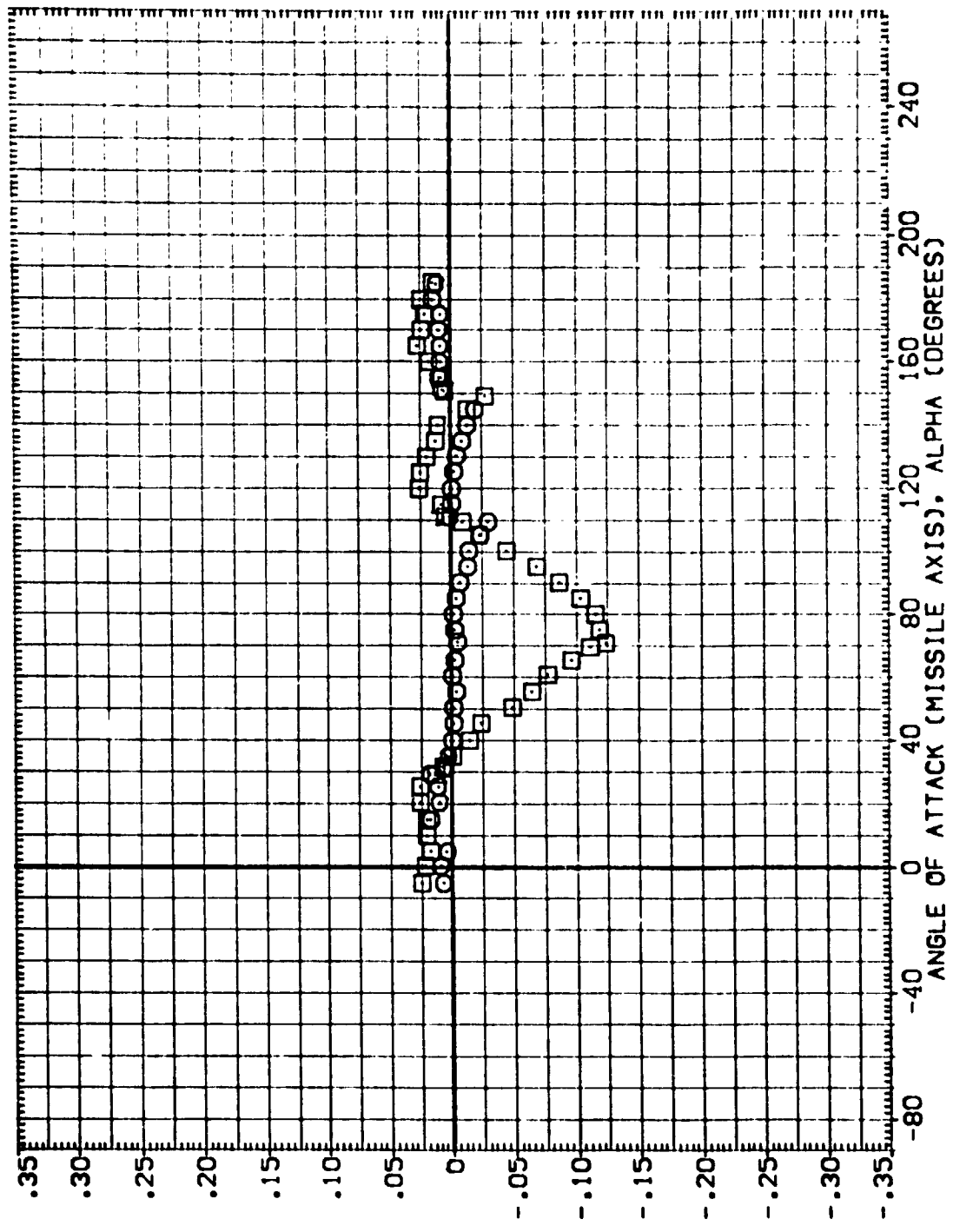


FIG. 10 BASIC TANK VERSUS TANK WITH PROTUBERANCES

(A)PHI = .00 (B)180.00

DATA SET
[CE
[VEYMO]



[A) P H I = . 0 0 (B) 1 8 0 . 0 0

DATA SET
[CE]



[(A)PHI] = .00 (B)180.00

DATA SET
(UEYH01)
(CE)

CS 3.5-196 TION DE IPTION
ARC 3.5-196 TASF ET (TANK WITH
ARC 3.5-196 TASF ET (TANK WITH
ARC 3.5-196 TASF ET (TANK WITH

\$)
PROTUBERANCES)
PROTUBERANCES)

MACH
10.400
10.400
10.400

REFE
SREF
LREF
BREF
XMRP
YMRP
ZMRP
SCALE

TION
594.1
300.
300.
1406.
.
.
.
.

NORMAL-FORCE COEFFICIENT (MISSILE AXIS), CNM

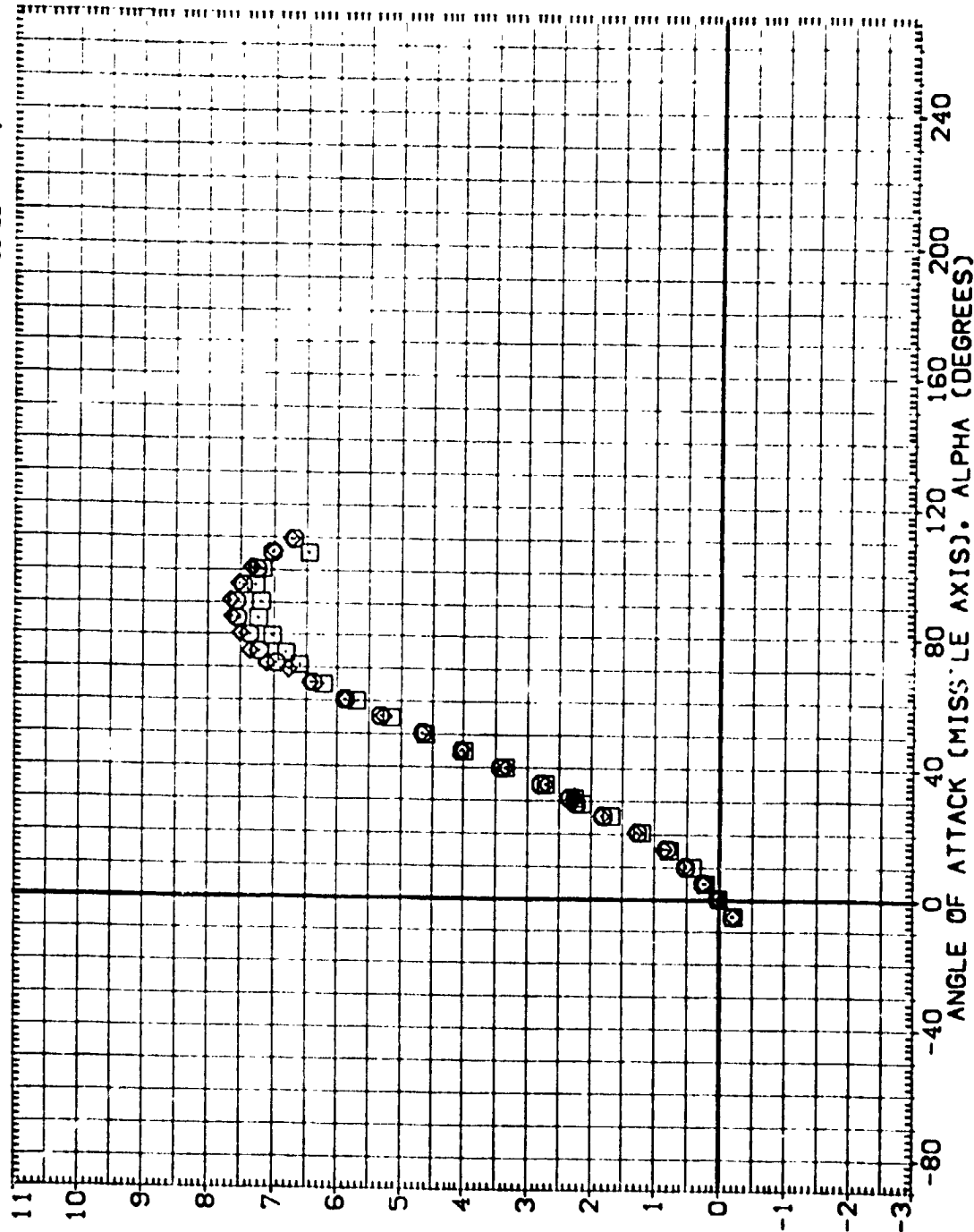


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = .00

6322

DATA	1	TION	ITION	USE	10.400	1.160	F	INF	TION
{	3.5-156	TAF	ET (TANK WITH	USE	10.400	1.160	LREF	594.1	50.FT.
{	3.5-156	TAF	ET (TANK WITH	USE	10.400	1.160	BREF	:	IN.
{	ARC 3.5-156	TAF	ET (TANK WITH	USE	10.400	1.160	:	:	IN.XT
{	:	:	:	:	:	:	:	:	IN.YT
{	:	:	:	:	:	:	:	:	IN.ZT

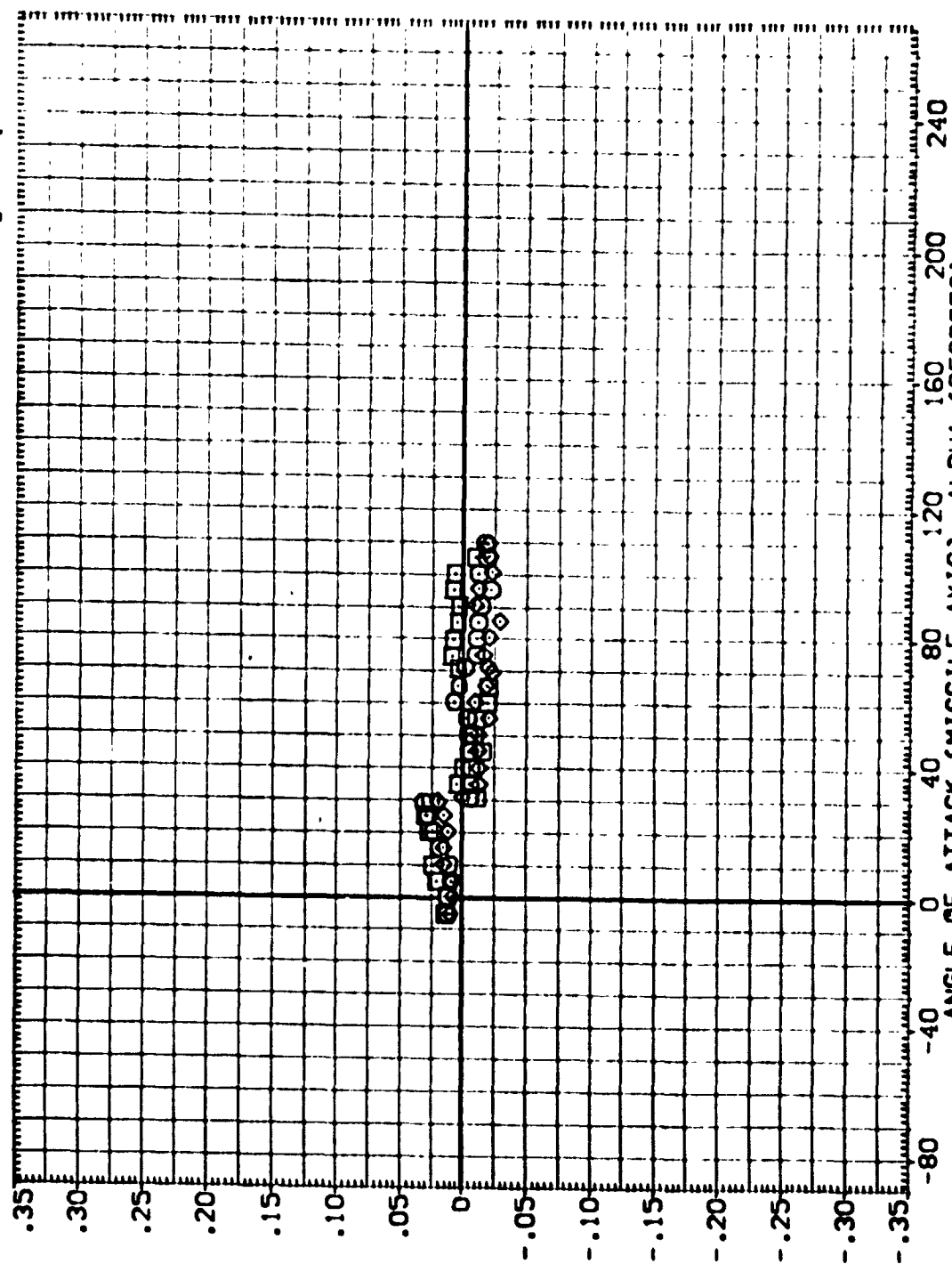


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = .00

DATA SET
(UEY01)
(CE)
(CE)

ARC 3.5-156 TAS ET (TANK WITH Y)
ARC 3.5-156 TAS ET (TANK WITH Y)
ARC 3.5-156 TAS ET (TANK WITH Y)

OPTION
TANK WITH Y
TANK WITH Y
TANK WITH Y

RM/L
1.150
.350
1.740

RE
SREF
LREF
BREF
YREF

NCE INF
.1
1406
.

TION
SO.FT.
IN.
IN.
IN.XT
IN.YT
IN.ZT

SCALE

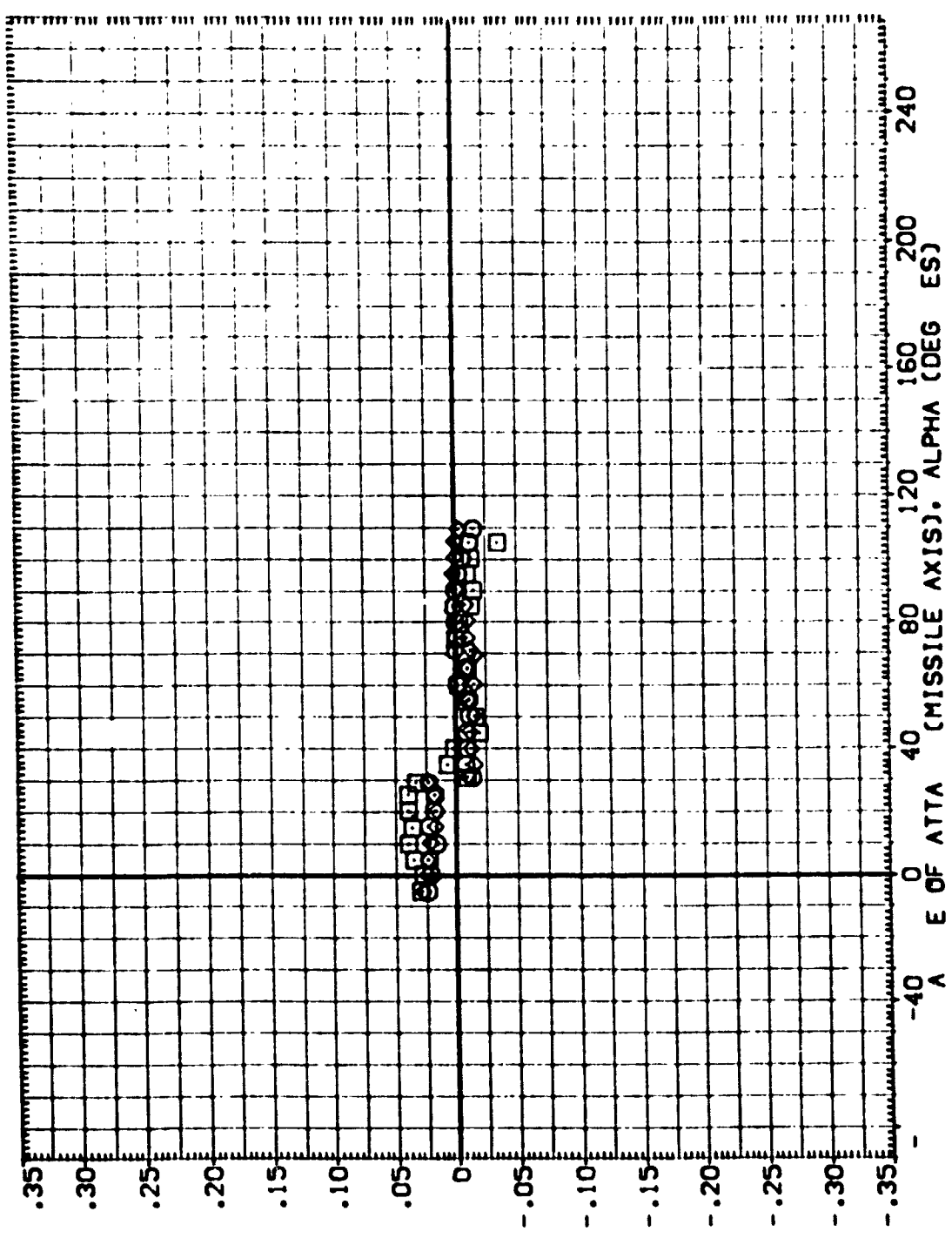


FIG. 11 C ARIS OF Y LDS NUMBERS

(A)PHI = .00

DATA	1}	1	OPTION	10.4	1.1	INF	TION
{	{	3.5-136	TASK ET (TANK WITH	10.4	1.1	.1	50.FT.
{	{	3.5-136	TASK ET (TANK WITH	10.4	1.1	.	IN.
{	{	3.5-136	TASK ET (TANK WITH	10.4	1.1	.	IN.XT
						.	IN.YT
						.	IN.ZT

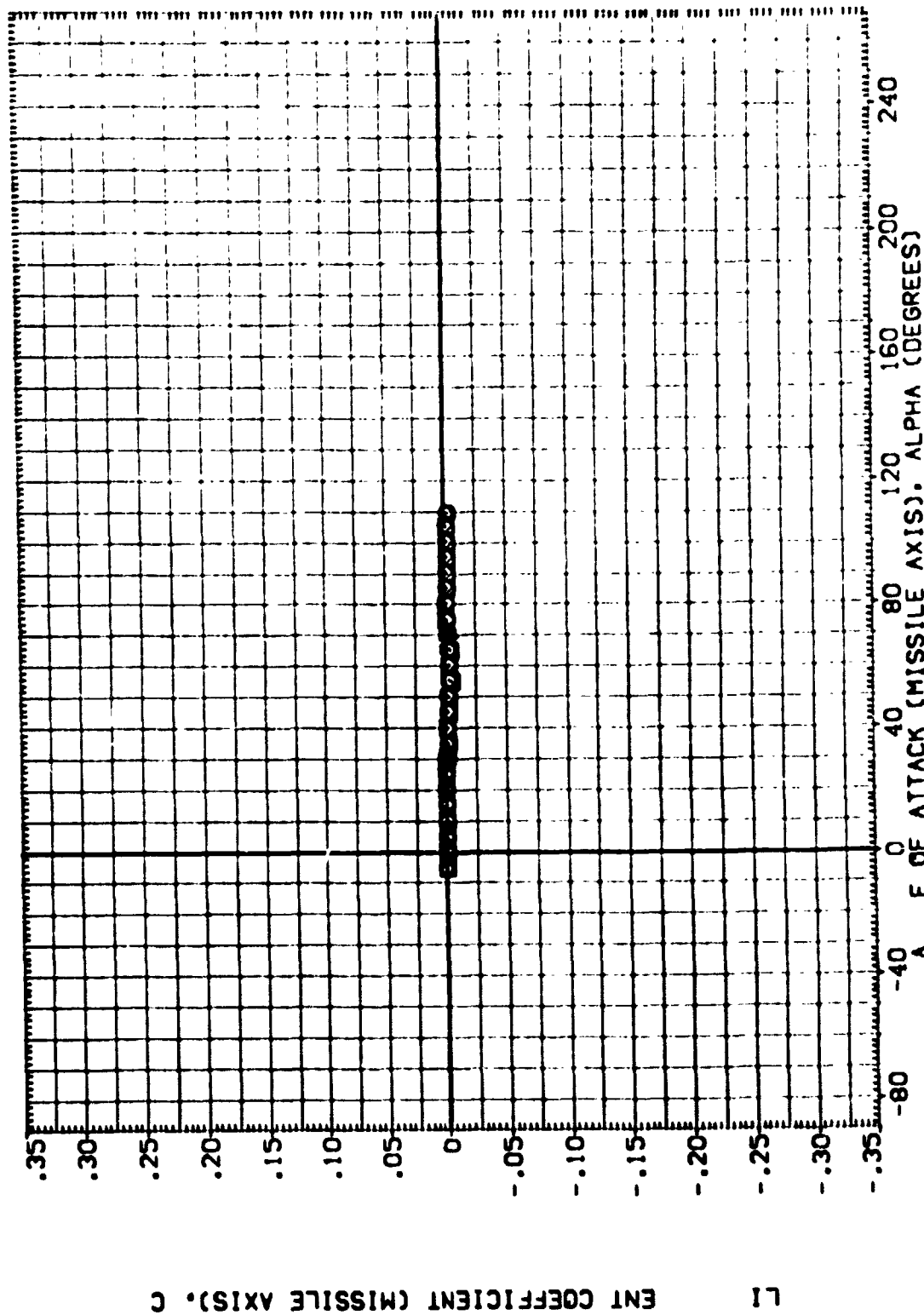


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = .00

DATA SET
[VEYMA]
[BEYMA\$]
[]

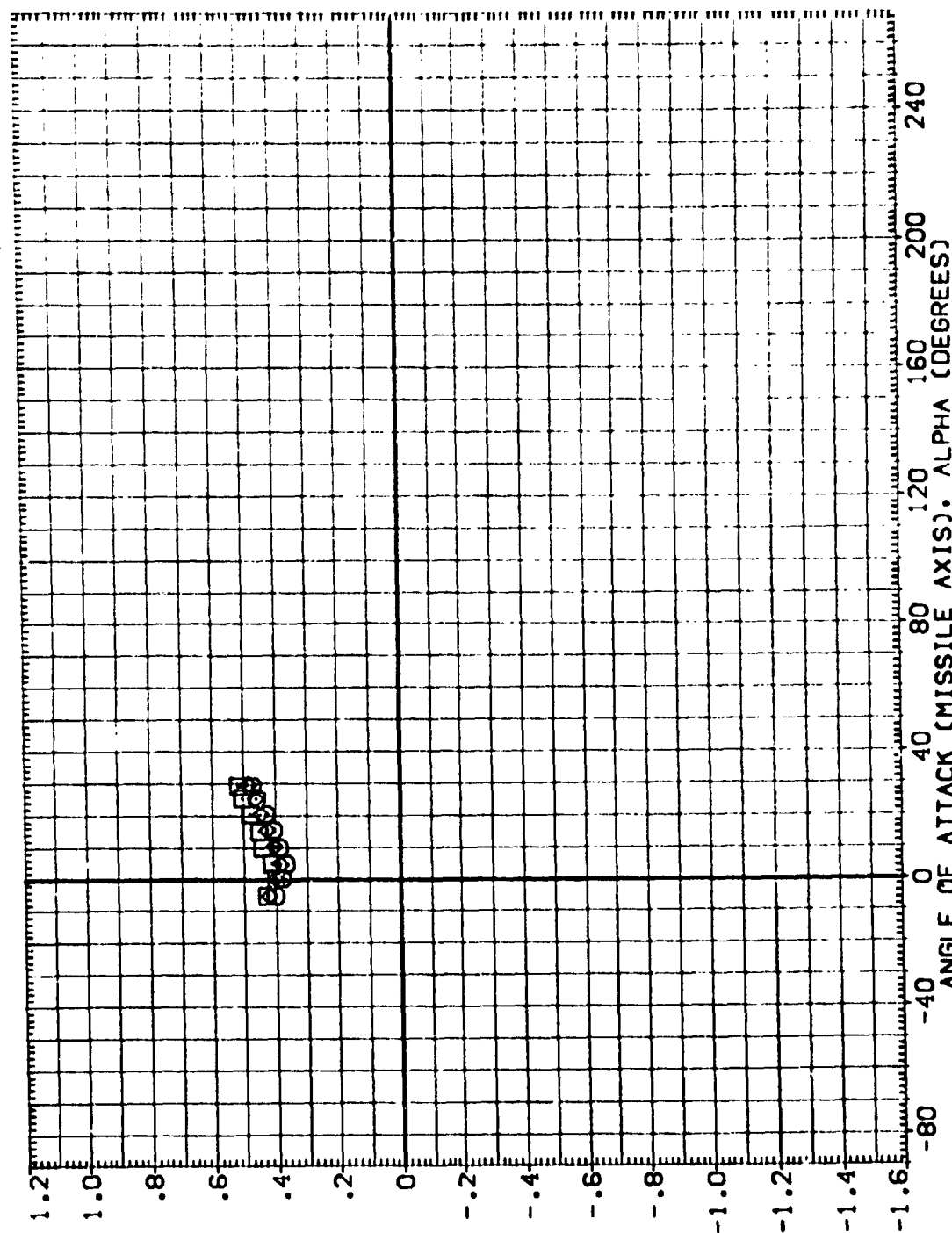


FIG. 11. COMPARISON OF REYNOLDS NUMBERS

$$[A]_{PHI} = .00$$

DATA SET
 (CEYMA1)
 (CEYMG1)
 (REYNAS)
 (REYNOS)

1 ACTION DE IPTION
 ARC 3.5-196 TAGF ET (TANK WITH PROTUBER S)
 ARC 3.5-196 TAGF ET (TANK WITH PROTUBER S)
 ARC 3.5-196 TAGF ET (TANK WITH PROTUBER S)
 ARC 3.5-196 TAGF ET (TANK WITH PROTUBER S)

MACH
 10.400
 10.400
 10.400
 10.400

RV/L
 1.160
 1.160
 .350

REFERENCE INFORMATION
 SREF 594.1360 SQ.FT.
 LREF 330. IN.
 BREF 330. IN.
 1406. IN.
 . IN.
 . IN.
 . IN.

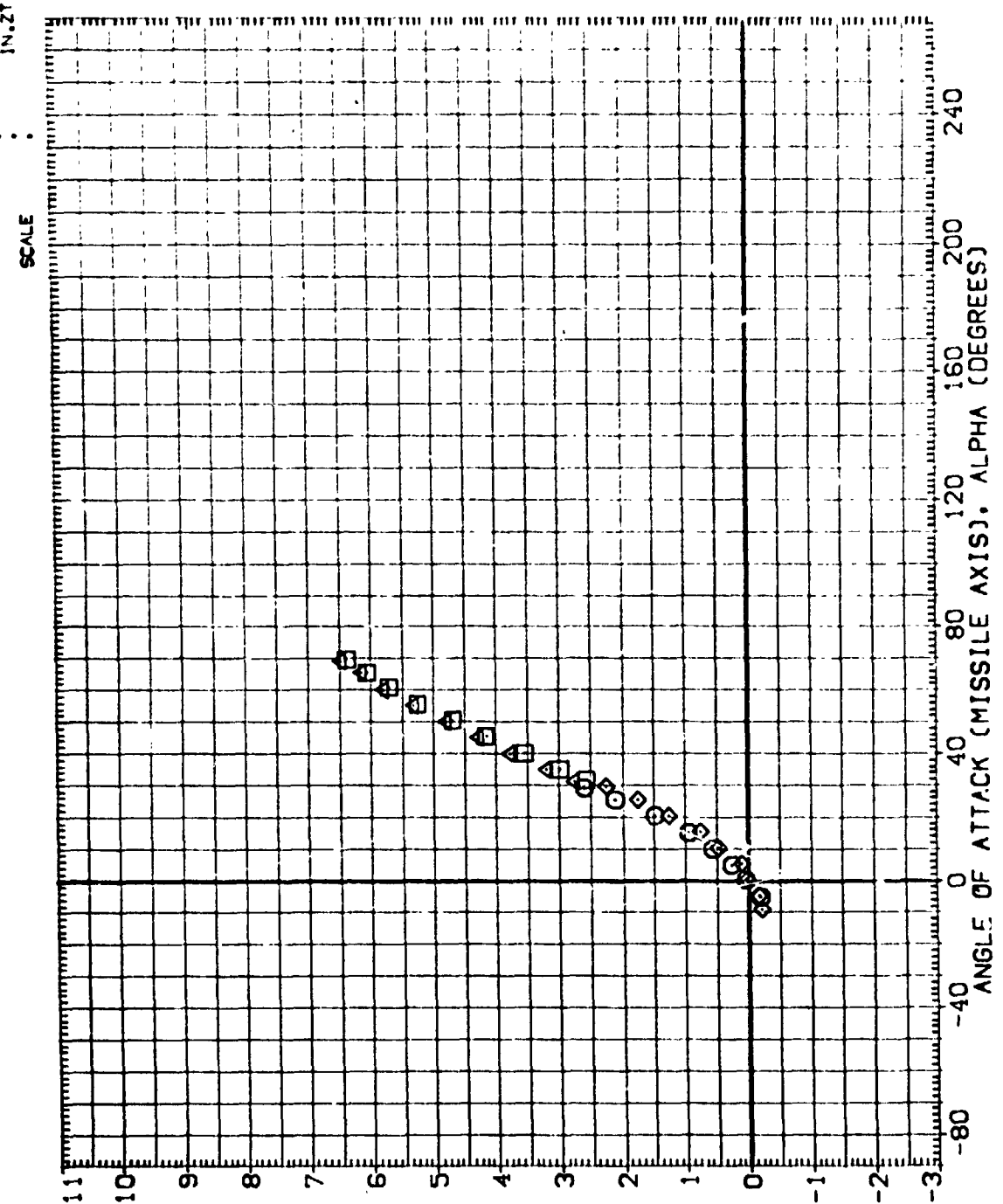


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = 180.00

DATA SET S	ARC 3.5-196	TANK WITH	PROTUBERANCES	MACH	RV/L	REFERENCE INF	TION
(CEYH1)	ARC 3.5-196	TANK WITH	PROTUBERANCES	10.400	1.160	SREF 594.1360	50.FT.
(CEYH1)	ARC 3.5-196	TANK WITH	PROTUBERANCES	10.400	1.160	LREF 330.	IN.
(RE	ARC 3.5-196	TANK WITH	PROTUBERANCES	10.400	.390	BREF 330.	IN.XT
(RE	ARC 3.5-196	TANK WITH	PROTUBERANCES	10.400	.390	XMRP 1406.	IN.YT
						YMRP	IN.ZT
						SCALE	

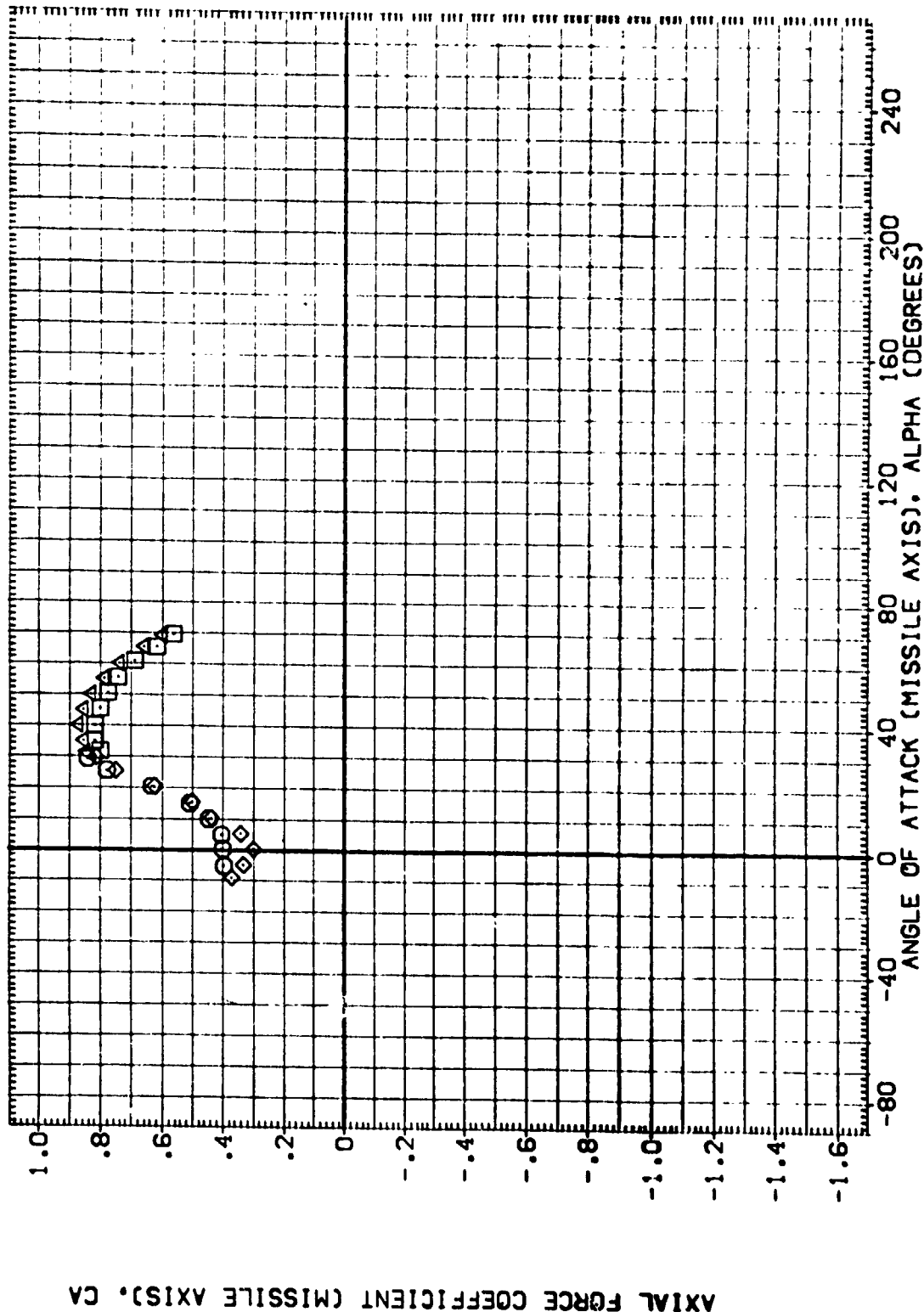


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = 180.00

DATA SET
 (CEYMA1)
 (CEYMG1)
 (RE)
 (RE)

ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES)
 ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES)
 ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES)
 ARC 3.5-196 TASF ET (TANK WITH PROTUBERANCES)

REFERENCE I
 SREF 594.1360
 LREF 330
 BREF 330
 1406
 YMRP
 ZMRP
 SCALE

RV/L
 1.160
 1.160
 .390
 .390

MACH
 10.400
 10.400
 10.400
 10.400

50.FT.
 IN.
 IN.
 IN.
 IN.
 IN.

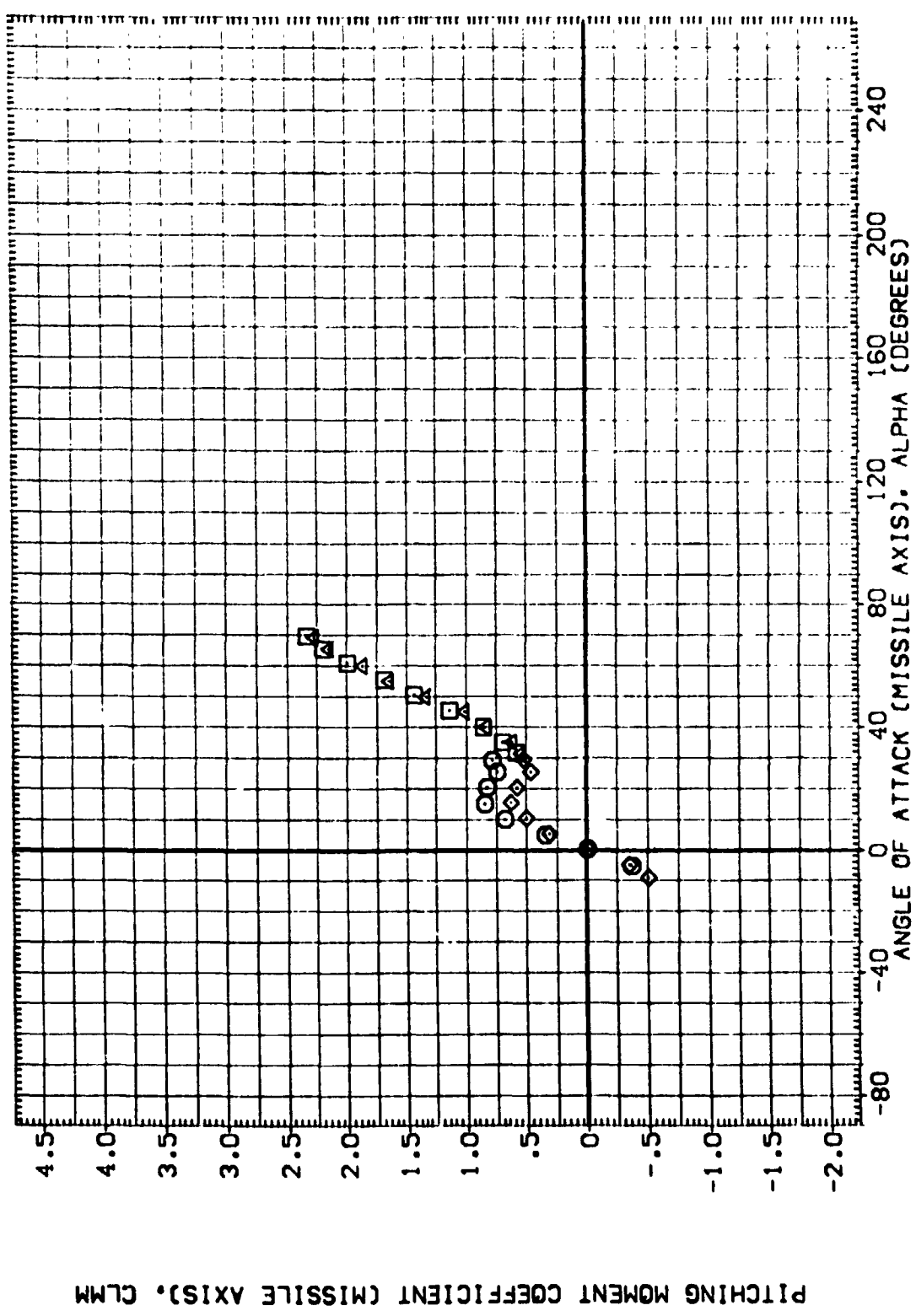


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = 180.00

DATA SET	ARC 3.5-196	TION DE	PTION	MACH	RM/L	SREF	NCE INF	TION
(CEYMA1)	ARC 3.5-196	TAS ET	(TANK WITH PRO	10.400	1.160	LREF	594.1360	50. FT.
(CEYMG1)	ARC 3.5-196	TAS ET	(TANK WITH PRO	10.400	1.160	BREF	300.	IN.
(REYMG6)	ARC 3.5-196	TAS ET	(TANK WITH PRO	10.400	.390	XPRP	1406.	IN. XT
	ARC 3.5-196	TAS ET	(TANK WITH PRO	10.400	.390	YPRP	.	IN. YT
						ZPRP	.	IN. ZT
						SCALE	.	

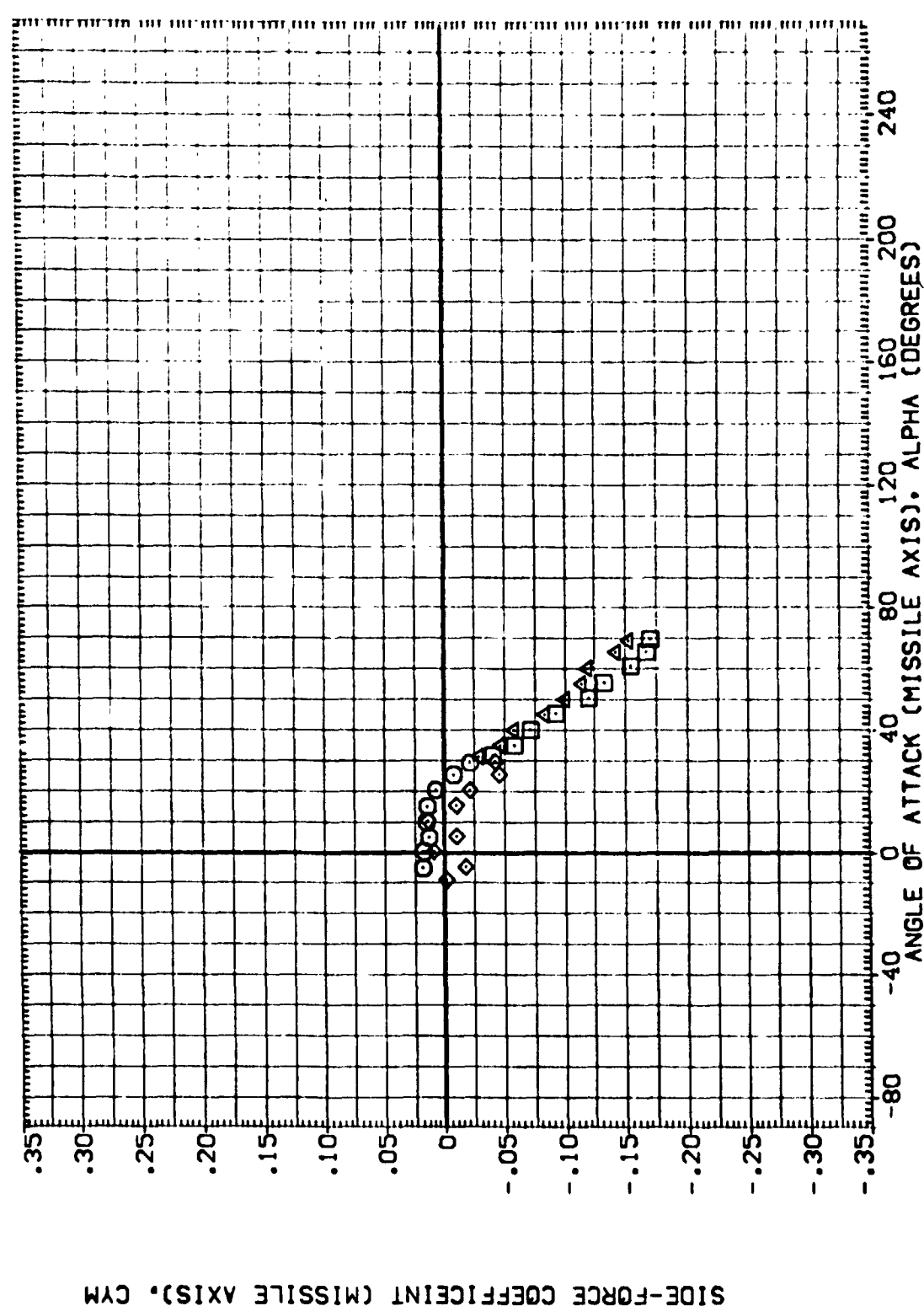


FIG. 11 COMPARISON OF REYNOLDS NUMBERS

(A)PHI = 180.00

```
DATA SET
(CEYMA1)
(CEYMG1)
(REYMAS)
(RE
```

DESCRIPTION

ARC 3.5-196 TAF9 ET {TANK WITH
ARC 3.5-196 TAF9 ET {TANK WITH
ARC 3.5-196 TAF9 ET {TANK WITH
ARC 3.5-196 TAF9 ET {TANK WITH

```
PROTUBERANCES)
PROTUBE    S)
PROTUBERANCES)
```

MACH 10.400
10.400
10.400
10.400

1.16
1.16
1.39
1.39

REFERENCE INFORMATION	
SREF	594.1360 SQ.FT.
LREF	330 IN.
BREF	330.2000 IN.
XMRP	1406. IN.XT
YMRP	. IN.YT
	. IN.ZT

SCALE

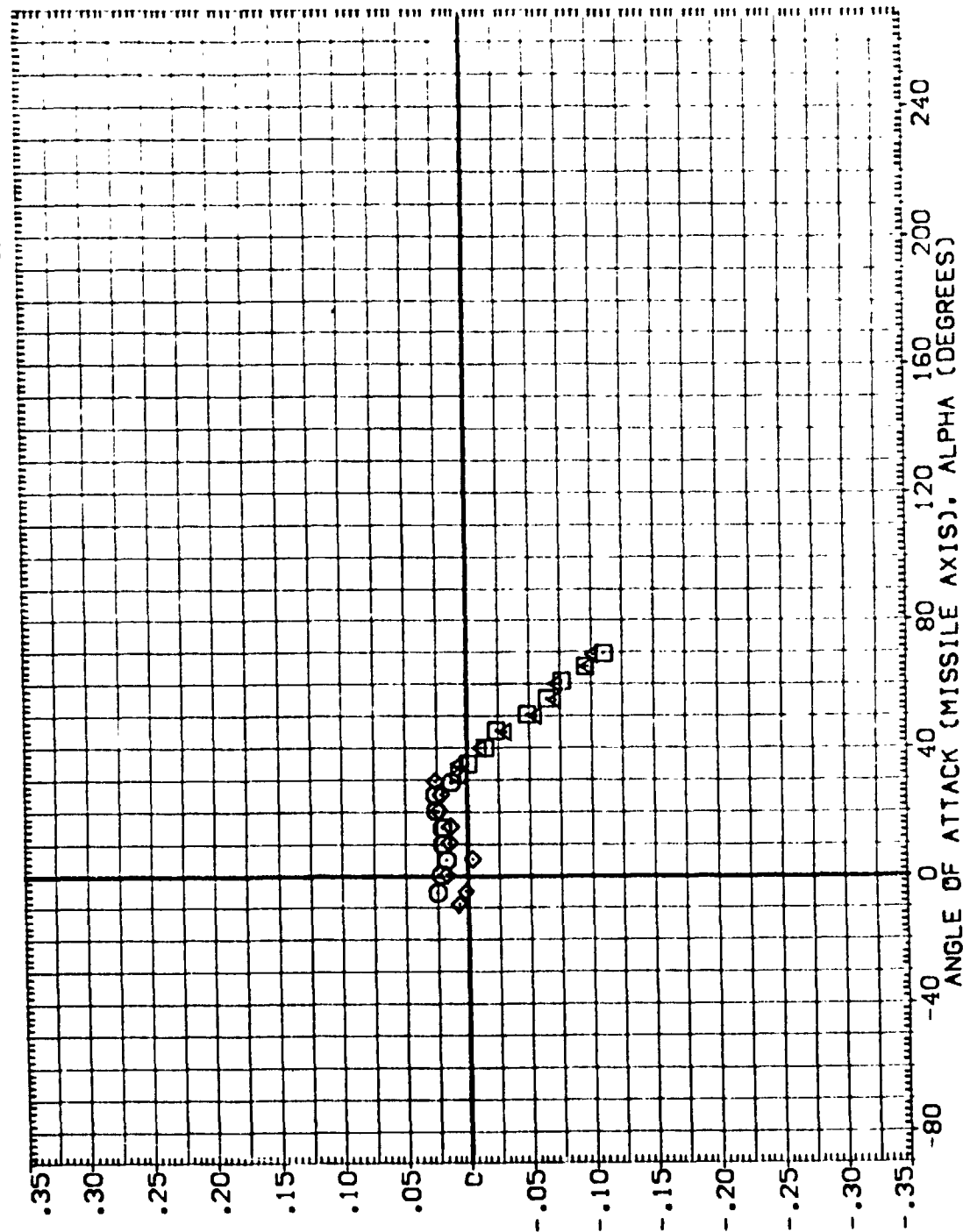


FIG. 11. COMPARISON OF REYNOLDS NUMBERS

(A)PHI = 180.00

DATA SET

{ DEYMAI }

{ DEYMG }

{ RE }

{ RE }

IGRATION DESCRIPTION

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES)

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES)

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES)

ARC 3.5-196 TAGF ET (TANK WITH PROTUBERANCES)

MACH

10.400

10.400

10.400

10.400

RV/L

1.160

1.160

.950

.950

REFERENCE INFORMATION

SREF 594.1360 SQ.FT.

LREF 330.2000 IN.

BREF 330.2000 IN.

YMRP 1406.0000 N.YT

ZMRP .0000 N.YT

SCALE .0000 N.ZT

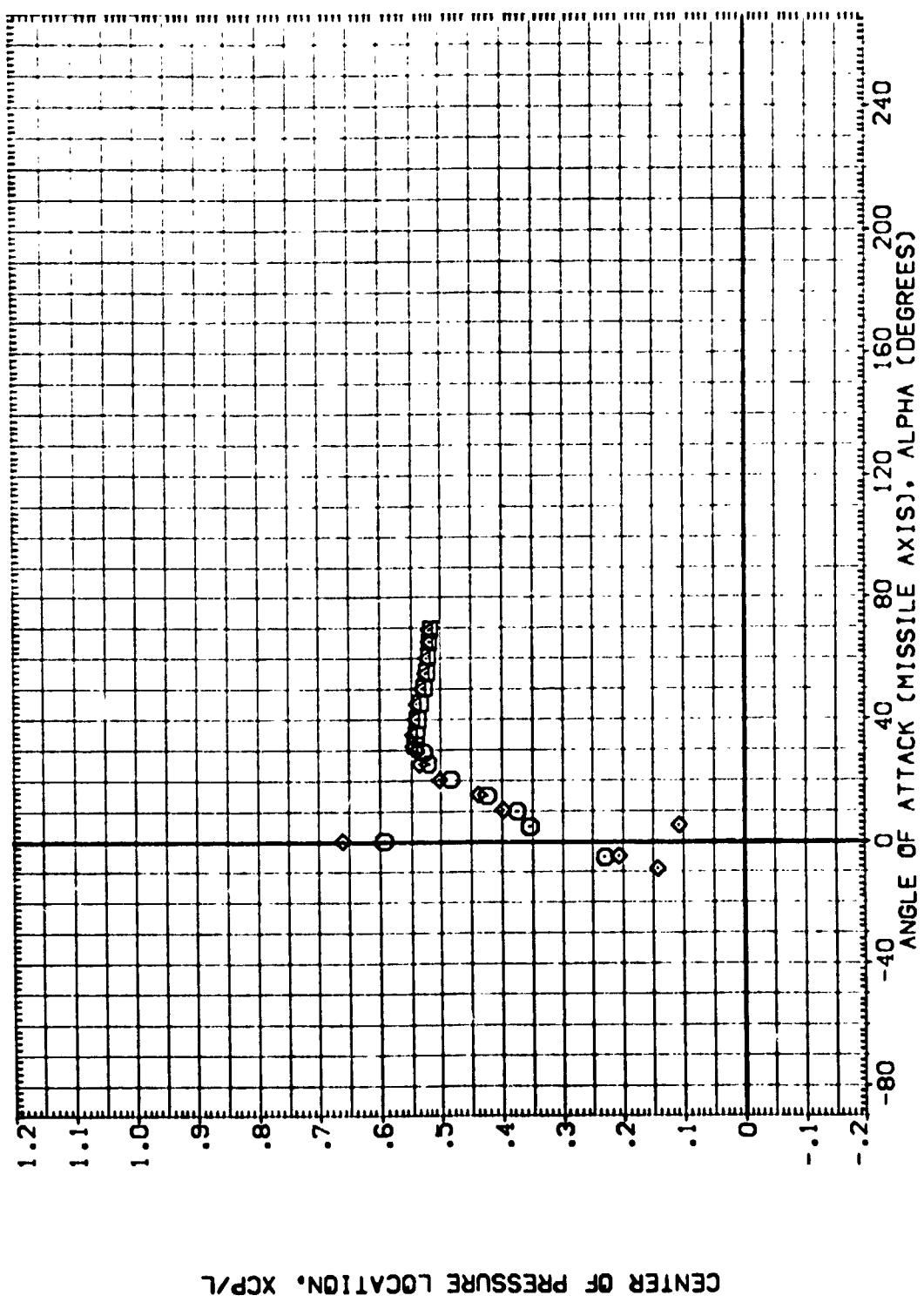
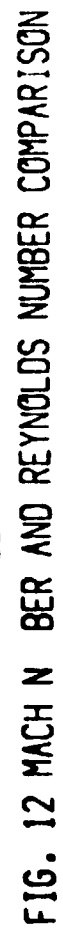


FIG. 11 COMPARISON OF REYNOLDS NUMBERS
(A)PHI = 180.00

INF 594.1
330.
330.
1406. . .



DATA (VEYNOI) }
 (CE
 I TION IPTION
 ARC 3.5-156 TASF ET (YANK VITH
 ARC 3.5-156 TASF ET (YANK VITH
 RE INF TION
 SREF SO.FT.
 LREF IN.
 1406: IN.
 : IN.YT
 : IN.ZT
 SCALE

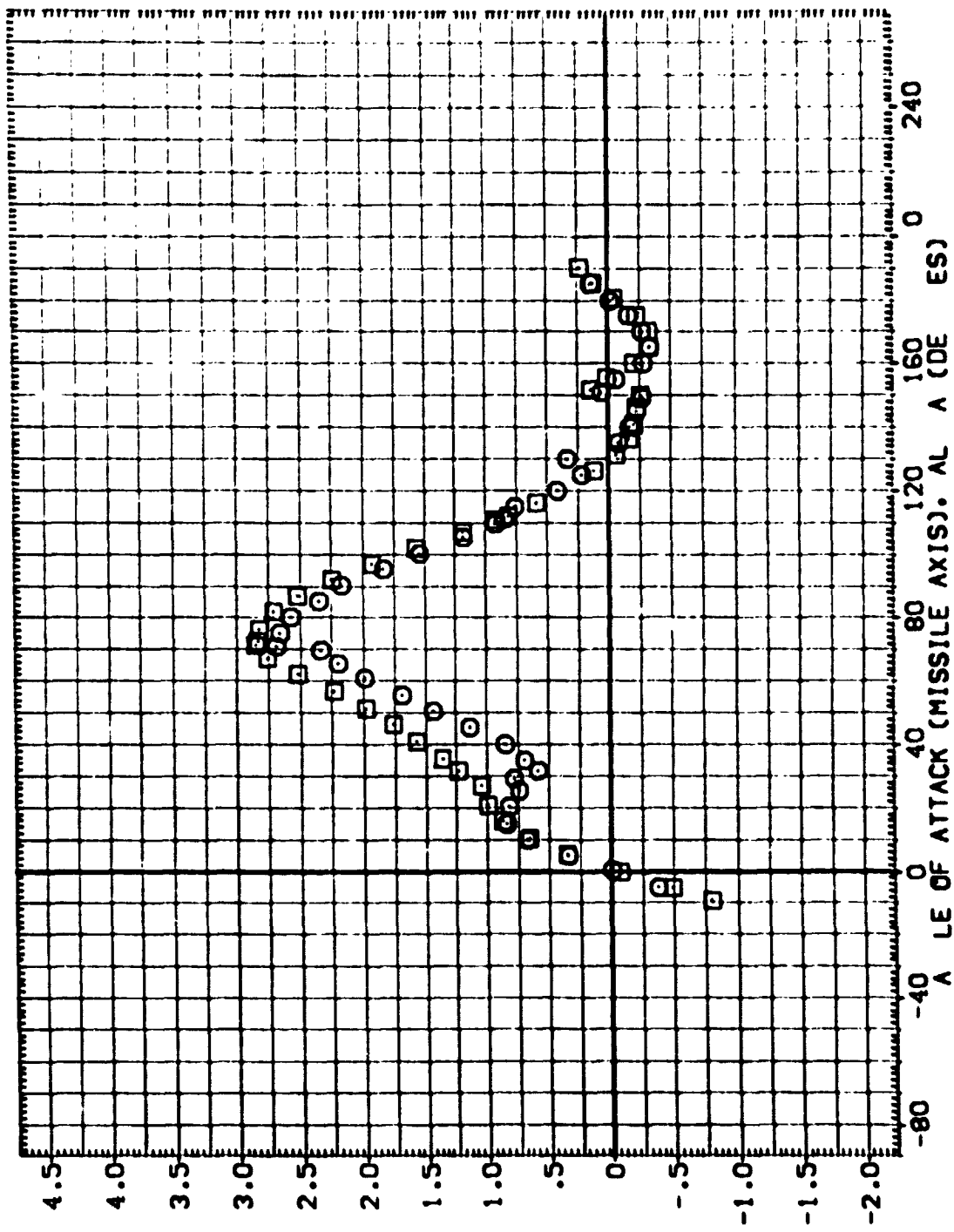


FIG. 12 MACH R AND REY LDS BER CO ARISON

(A)PHI =1 .00

DATA { }
 3: 1 1 3: 1 1 3: 1 1
 TION TION TION
 90.FT. 90.FT. 90.FT.
 IN. IN. IN.
 IN. XT IN. XT IN. XT
 IN. ZT IN. ZT IN. ZT

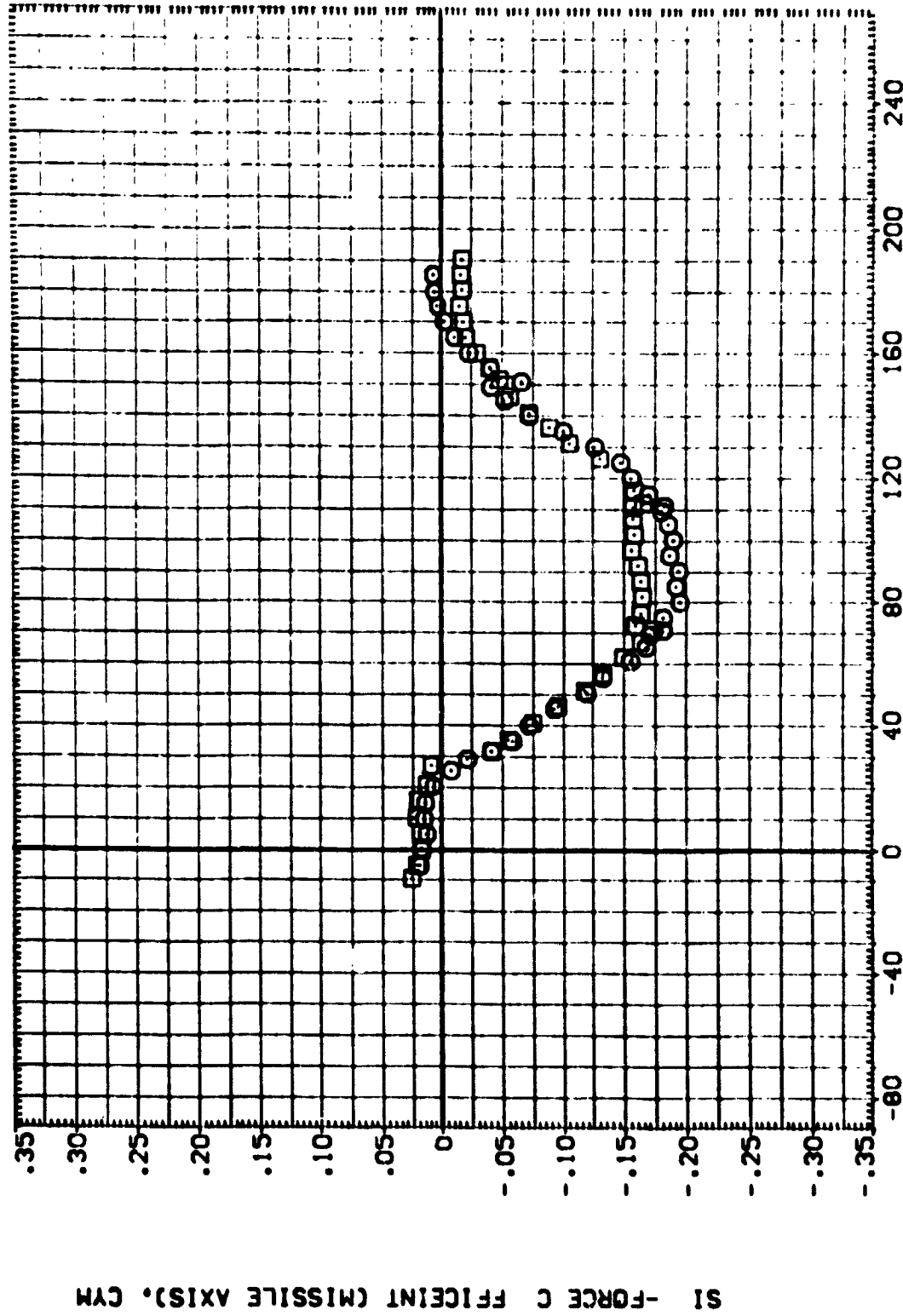


FIG. 12 MACH R A YNOLDS MBER COMPARISON

(A) I = 180.00

	DATA SET		I	TION	PTION		ANAL	NCE I	TION
[]	{NEWMOI}	ARC 3.5-196	TAS	EY	(TAKI WITH)	1.160	.	SQ.FT.
	{CE	ARC 3.5-196	TAS	EY	(TAKI WITH	\$)	3.810	:	IN.
					PROCT			:	N.XT
								:	N.YT
								:	N.ZT
								1406:	
							F	.	
							LREF	.	
							BREF	.	
							YMPP	.	
							SCALE	.	

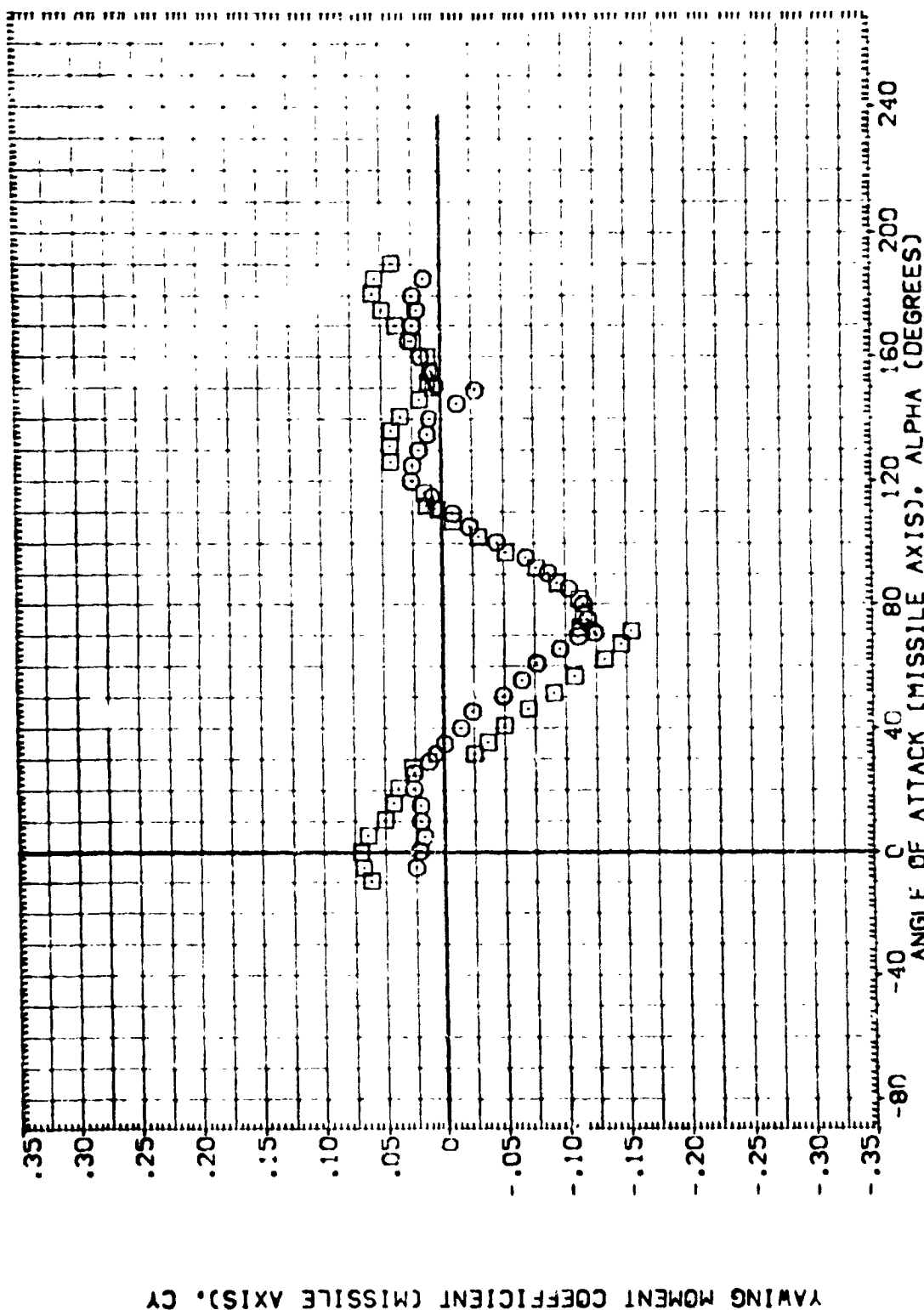


FIG. 12 MACH NUMBER AND REYNOLDS NUMBER COMPARISON

(A)PHI = 180.00

DATA SET S	CONFIGURATION DESCRIPTION	MACH	RN/L	REFERENCE INFORMATION
(VEYMO1)	ARC 3.5-196 TAB ET (TANK WITH PROTOBERANCES)	10.400	1.160	SREF 594.1360 SC.FT.
(CEYMO3)	ARC 3.5-196 TAB ET (TANK WITH PROTOBERANCES)	5.300	3.810	LREF 330.2000 IN.
				BREF 330.2000 IN.
				1406.0000 IN.XT
				YMRP .0000 IN.YT
				ZMRP .0000 IN.ZT
				SCALE .0360

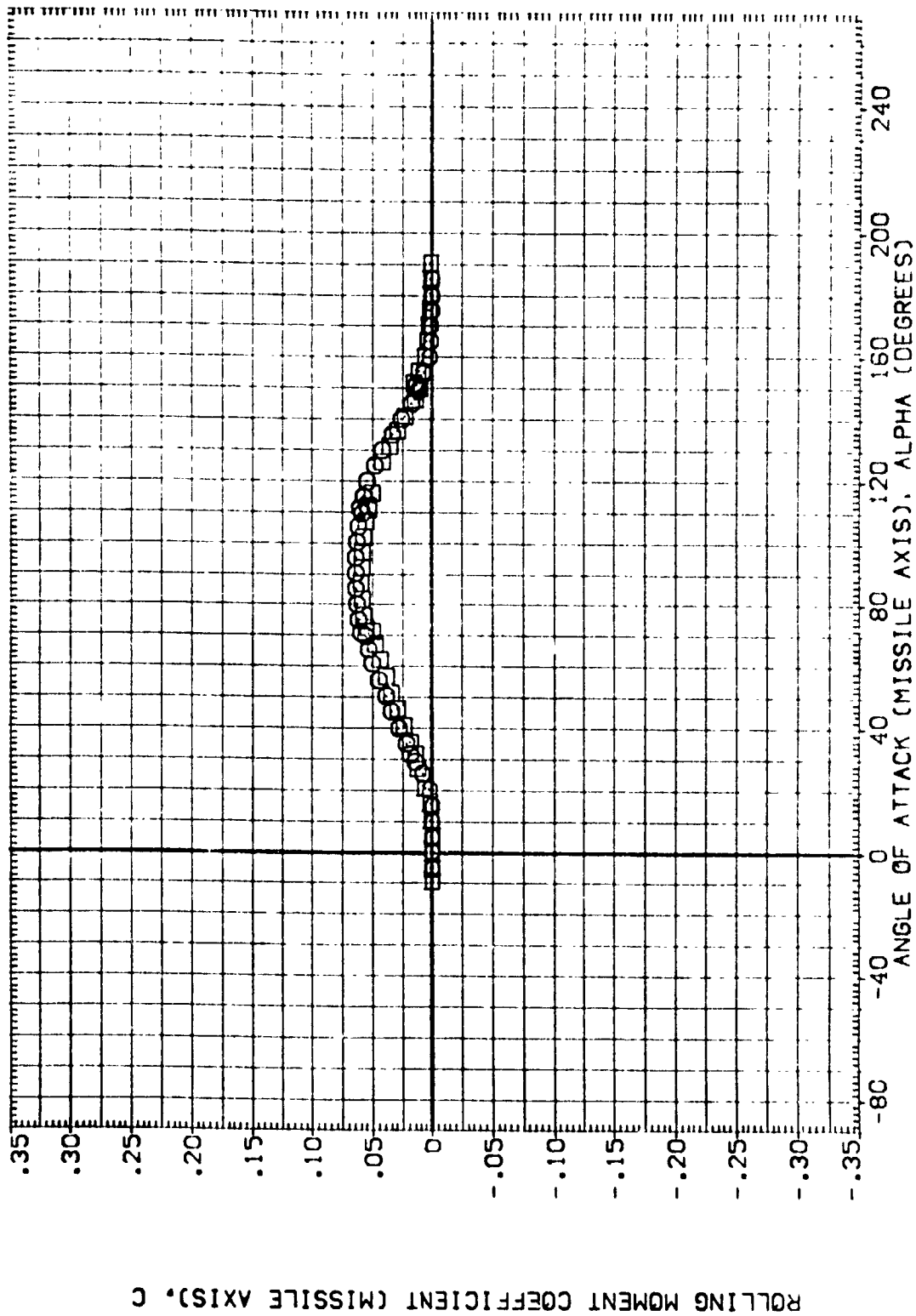


FIG. 12 MACH NUMBER AND REYNOLDS NUMBER COMPARISON

(A)PHI = 180.00

DATA SET
 (VEYMO1)
 (CE)

IGRATION DESCRIPTION
 ARC 3.5-196 TASF ET (TANK WITH PRO R S)
 ARC 3.5-196 TASF ET (TANK WITH PROUBERANCES)

MACH
 10.400
 5.300

REFERENCE INF
 SREF 594.1360
 LREF 330.
 BREF 330.
 XREF 1406.
 YREF .
 ZREF .
 SCALE .

TION
 SO.FT.
 IN.
 IN.XT
 IN.YT
 IN.ZT

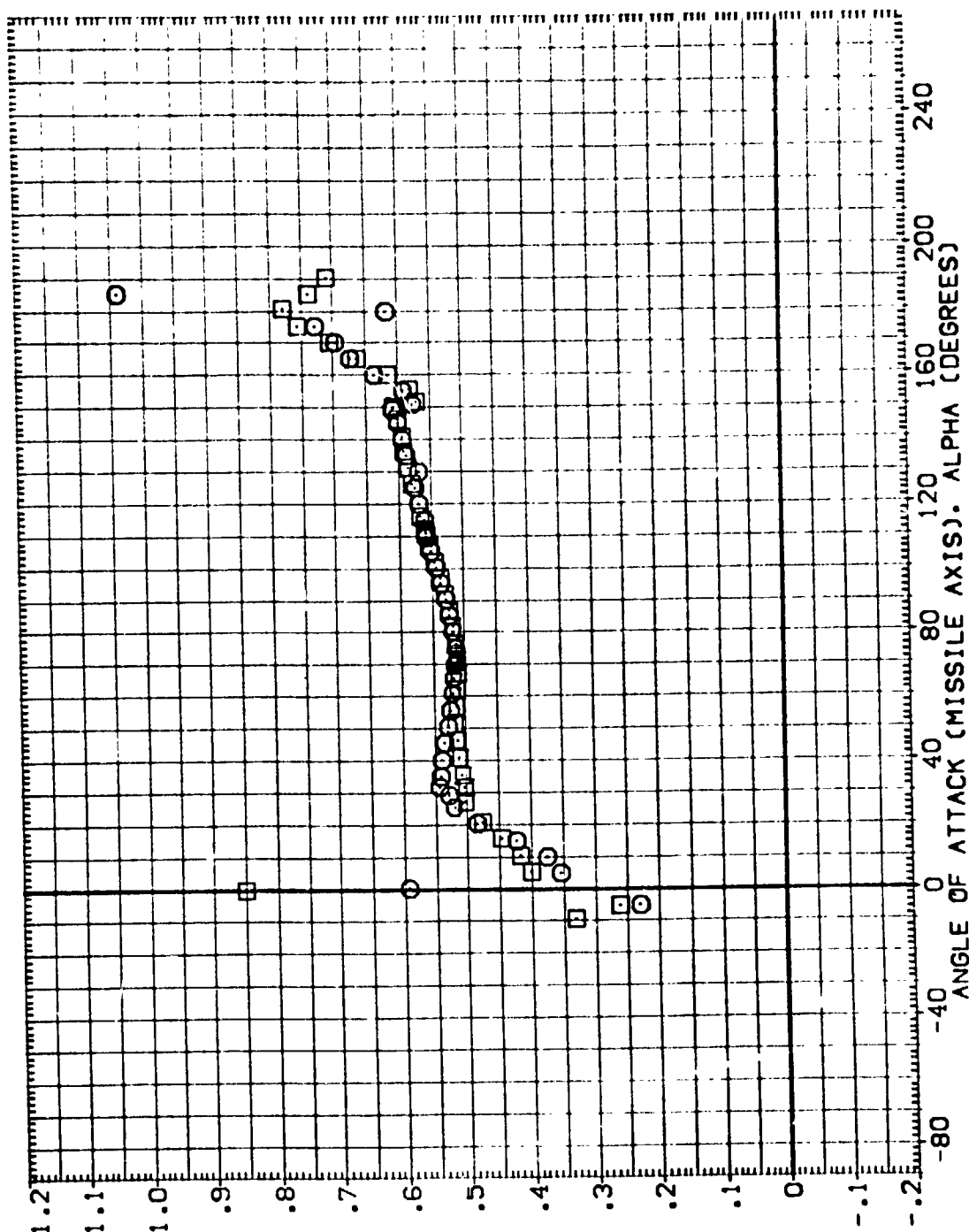


FIG. 12 MACH NUMBER AND REYNOLDS NUMBER COMPARISON

(AJPHI) = 180.00

APPENDIX
TABULATION SOURCE DATA

Plotted data tabulations are available from
Data Management Services on request.